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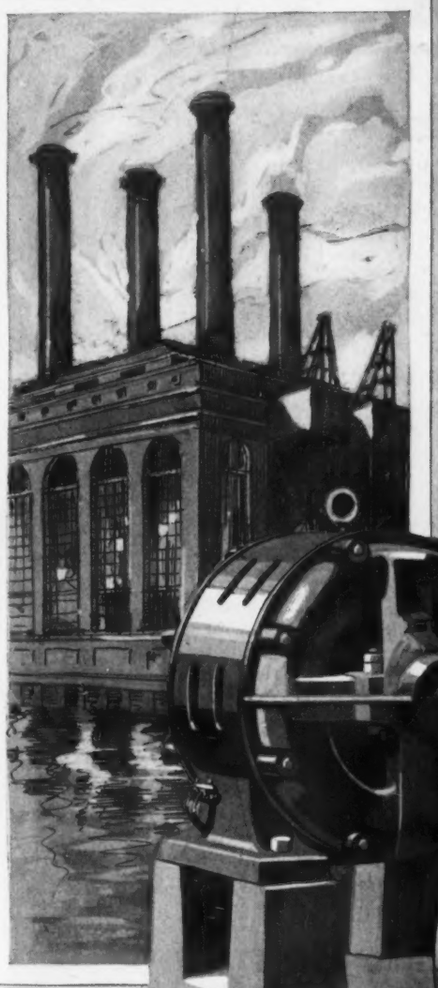

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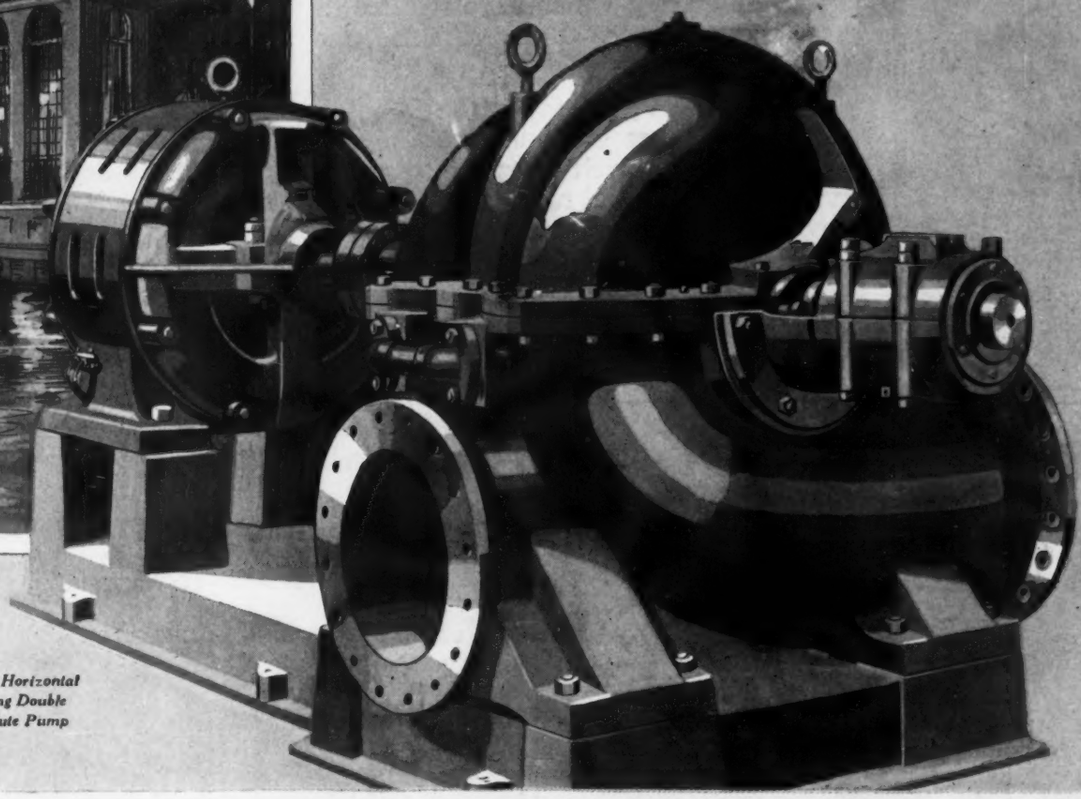

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The Election and the Political Outlook

ELECTION day has come and gone. and as a result of the Republican landslide it is reasonable to assume that official Washington will hereafter shrink within the confines of the District of Columbia. The change of administration may mean much or may mean little to the country. Certain it is that miracles cannot be performed by merely changing parties, nor can the country's enormous debts be liquidated by resolutions or wishes. The whole world is steeped in debt, filled with unrest and is lacking in materials and comforts. Nothing short of increased production can save it, and if the new administration will take steps to insure greater productivity and efficiency by unfettering business and stimulating labor, peace and prosperity will in fact ensue. Our foreign trade will depend in part on the needs of the outside world and its ability to pay, and in part on our political and civic relationship to it.

Will Illinois Utilities Become a Political Football?

IF THE campaign arguments of Len Small, the newly elected Governor of Illinois, are to be taken at face value, the utilities of that state will soon be without a regulating commission. It must be remembered, however, that the victory was won as part of a tremendous national landslide, and that it is the Legislature and not the Governor that makes or unmakes laws. Hence the apparent indorsement of the proposal to abolish the commission may not be so strong as it would otherwise seem. At any rate, it is to be sincerely hoped that a controversy which has developed largely from the street-railway situation in Chicago will not result in making a political football of the utilities of the entire state. The principle of regulation is too well established to be thus ruthlessly cast aside.

Moral Obliquity in Business

WIDESPREAD cancellation of contracts indicates a diseased condition of business morals which will sooner or later be reflected in litigation in the courts. Certainly no community or business can exist and prosper where contractual engagements carry no binding obligations. One great fault found with labor is that it will not live up to its agreements and will strike on the least provocation. It is generally assumed that general business is not tainted with such practices. However, recent events indicate that in some sections contracts, like labor agreements, are mere scraps of paper. Without regard to the financial loss entailed upon the manufacturer or to the salability of the goods, cancellations of contracts are being made with impunity. Of course, legal covenants can be enforced, but in many instances manufacturers may deem it wiser as a matter of policy to wink at the infractions. This, however, only makes matters worse and eventually leads to business chaos. There must be a greater recognition of the integrity of contracts. In the opinion of Roger W. Babson, the statistician, the prevailing moral obliquity is amenable only to religion. He contends that the religion of communities is really the bulwark of business and that the value of investments depends not upon the strength of banks but rather upon the strength of churches.

The Stage Is Set for Action

THE stage is set. Next Thursday the Engineering Council of the Federated American Engineering Societies meets in Washington for the first time. Sixty thousand engineers will be represented. We urge those who attend the meeting to spend their time in an honest effort to secure a broad and fundamental program of endeavor for the federation and not to lock horns or waste precious time in argument on small detail. For years the engineers of this country have talked of such an organization. The action taken next week will demonstrate their ability to work together for a common cause.

Educating the Security Holder

AT PRESENT the securities of most electric light and power companies are very attractive. The prices are low and the yield is high, and as the cost of commodities decreases the value of the securities will naturally be enhanced because of the greater purchasing power of the dollar. To enable all electric light and power companies to bring this situation forcibly to the attention of security holders, publicists and men of standing in the various communities, the National Electric Light Association has issued a series of booklets dealing with the subject in an authoritative and convincing way. While the booklets are chiefly of financial interest, they also have a public policy angle which must not be lost sight of. Needless to say, every public utility manager will want a plentiful supply of the booklets for local distribution. The necessity of continued expansion of utility service and of improving the credit of the companies is obvious to those in touch with conditions, and for the purpose of spreading this information the booklets are excellent, However, to be efficacious they must be placed in the hands of the responsible citizens of every community.

Definite Fuel Clauses Important

A TENDENCY toward inserting fuel clauses of indefinite phraseology has been observed lately in a few central-station energy rate schedules and contract addenda. The practice has not become at all widespread, but it should be nipped in the bud. In this important department of public relations every modifying clause in rate determinations should be as simply and as clearly expressed as executive and engineering intelligence can insure. When the technical clarity of the fuel clause is established let the lawyers be called in, if necessary, but not until the objects sought are put down in black and white in a way that is understandable by engineers of average training and experience and explainable to purchasers of reasonable enlightenment. When considered as a means of maintaining good relations between utilities and their patrons, mere general statements about the rates going up and down in proportion to the cost of fuel are not to be compared with exact language setting forth the precise modifications entailed per unit of energy sold as production costs vary.

Interconnection Enables Better Use of Reserve Equipment

SOME interesting facts regarding the power supply in the territory east of the Alleghanies, including western Pennsylvania and eastern Ohio, are disclosed this week in a brief paper by Captain Whitsit reporting an investigation made for the War Industries Board. As every one knows, this is a region of intensive industrial development and yet one in which water power necessarily plays a somewhat insignificant part. The central stations in the power plants through this territory have an aggregate rating of about 750,000 kw., and their output in 1918 was nearly 2,500,000,000 kw.-hr. The significant fact appears, too, that during that year the sum of the power peaks reached 568,000 kw. There was therefore a total of 200,000 kw. reserve capacity, mostly unavailable through lack of interconnection. The plants that went to make up the aggregate showed enormous variations in efficiency, and besides a large capacity in isolated plants which will probably take central-station service later there is a very big total of generating equipment in some of the larger iron and steel companies which is not likely to be replaced. As things are now moving Captain Whitsit estimates that in six or seven years the total peak on the central-station systems, apart from the needs of the steel industry and of electric railways, will run over 1,000,000 kw., while the total added power demand will go to 1,400,000 kw., nearly double the present rating of the central-station systems.

The chief recommendations made are that new equipment should be installed at the points most available from the standpoint of coal supply and condensing water. Here is characteristically a region which should depend on coal at or near the mouth of the mine. The best locations apparently lie along the Ohio and some of its tributaries. There are some possible hydro-electric developments in western Pennsylvania which might be brought into line with existing or future steam-power plants with good results. The ultimate capacity of these hydro-electric possibilities bulks rather large according to Captain Whitsit, reaching something like 800,000 kw., or a rating fully equal to the total capacity of the existing central stations. From an economic standpoint such hydraulic developments are likely to pay, since with the increasing cost of labor and fuel hydro-electric plants will afford an increasing advantage. They must, however, be worked in harmony with the original steam plants to obtain the best results, because in years of low water the possible developments will fall very far below the average conditions just noted. The situation in the region here considered is distinctly different from that in the Southern States, where the hydro-electric plants are able to bear a far larger proportion of the aggregate burden.

Construction Accounting and Economy

EXPERIENCE has shown that in very many cases systematic attention to construction accounting is productive of considerable economies. It is, however, necessary to take an extremely common-sense view of this and all other systems of accounting, making, so to speak, the punishment fit the crime. Unless operations are on a very large scale, the segregation of items which in themselves may well be considered separately becomes impracticable, and details have to be lumped, to the shortening of a generalized schedule like that which we publish in this issue. Clerical detail may thus be saved without losing any of the real information which a schedule is intended to present. The same principle of common-sense adaptation of means to the situation runs through the whole scheme of accounting. It would be really interesting to know the relation of accounting costs to general costs in some central-station systems which we could mention, to say nothing of other forms of business. There comes a time when it costs more to preserve details than the details are worth; hence we emphasize the fact that orderly, systematic schedules like those presented on Oct. 30 should never be slavishly followed without reference to the existing situation, having in mind especially the need of such records and the cost of maintaining them.

Making Overhead Welds Successfully

UNLIKE ordinary welding, overhead welding has to contend with the force of gravity, which acts against the deposition of metal and renders it difficult to retain molten metal on the working surface. This fact must be taken into consideration if satisfactory overhead welds are to be made and operations so conducted that full utilization shall be made of the forces, whatever they are, that really cause the transition and retention of the molten metal.

Some new ideas that may be useful in a consideration of the technique of making such welds are presented in this issue by O. H. Eschholz. For instance, he points out that the globules successively formed at the electrode end must be made to coalesce with the pool above. This depends on the difference between the surface tensions of the positive and negative terminal materials; therefore the physical characteristics of the metal in the electrode must be different from those pertaining to the work. Furthermore, the surface of the electrode must not be allowed to become wetted with melted material, else the fresh material would cling to the electrode instead of going to the work. The cohesive force between the liquefied globule at the end of the electrode

and the electrode itself depends on many things—composition, area of contact, arc current and length. Above all, success turns on the skill of the operator in working off the molten material before gravity gets him into trouble. What data are available regarding the effect of composition of electrode indicate, as might be expected, that small impurities and occluded gases tend to decrease the cohesion between the solid and melted matter and make it easier to lay on successive globules.

New Aspect of Lightning Protection

MOST operating men have been of the opinion that an overhead distribution system with dense load and many transformers offers a better target for lightning discharge than one with scattered load. A recent investigation by D. W. Roper, reported in this issue, however, makes it evident that where a lightning arrester is installed at each transformer the lightning has a multiplicity of paths through which the voltage gradient of the atmosphere may be smoothed out when the density of the lighting arresters is high with less trouble at the transformer. From careful tests made on the 4,000-volt, 60-cycle distribution system of the Commonwealth Edison Company, it appears that the density of lightning arresters on this system is far more important than the actual type of arrester used. Curves show that where the density of transformers and arresters is 200 per square mile, not only is the percentage of disturbance due to lightning greatly reduced, compared to a density of 100, but the actual number of interruptions is cut nearly in half.

Of equal importance is the matter of protecting underground cables. Where these cables are connected to the overhead lines there is a transition point which is especially susceptible to lightning disturbances and which has given serious trouble in the past. The results obtained by Mr. Roper indicate that underground cables can be effectively shielded from lightning by increasing the density of arresters in the vicinity of the point at which the cable emerges.

One cannot help reflecting on the futility of laboratory tests of arresters for such a system as this. Tests made in the laboratory may eliminate some weaknesses and undesirable features, but the only complete test, apparently, is in actual service. This is particularly important with low voltage since it is difficult to design arresters for 4,000-volt circuits, bearing in mind the high voltages which occur in connection with actual lightning discharges. Too much emphasis cannot be laid upon the value of systematic study or research in the great laboratories of practical operating companies. Intelligent study in the field is bound to bring out the important considerations, if not the actual solutions.

So far it is safe to say that the results are more or less applicable to other systems operating under somewhat similar conditions, but great care should be exercised in extending the conclusions to systems with conditions unlike those in Chicago. For instance, it was found that one type of arrester was considerably more effective in Chicago than the others; but it may easily be conceived that pole-line construction and local conditions may influence such a result. The only way to find out what arrester is satisfactory for a particular system in the present state of our knowledge of the subject is to conduct a complete test under the actual conditions imposed by the service.

Among the important conclusions drawn from the Roper tests is that trees and buildings constitute effective barriers against lightning discharges. The records in Chicago show that many transformers have been completely shielded from lightning by their presence.

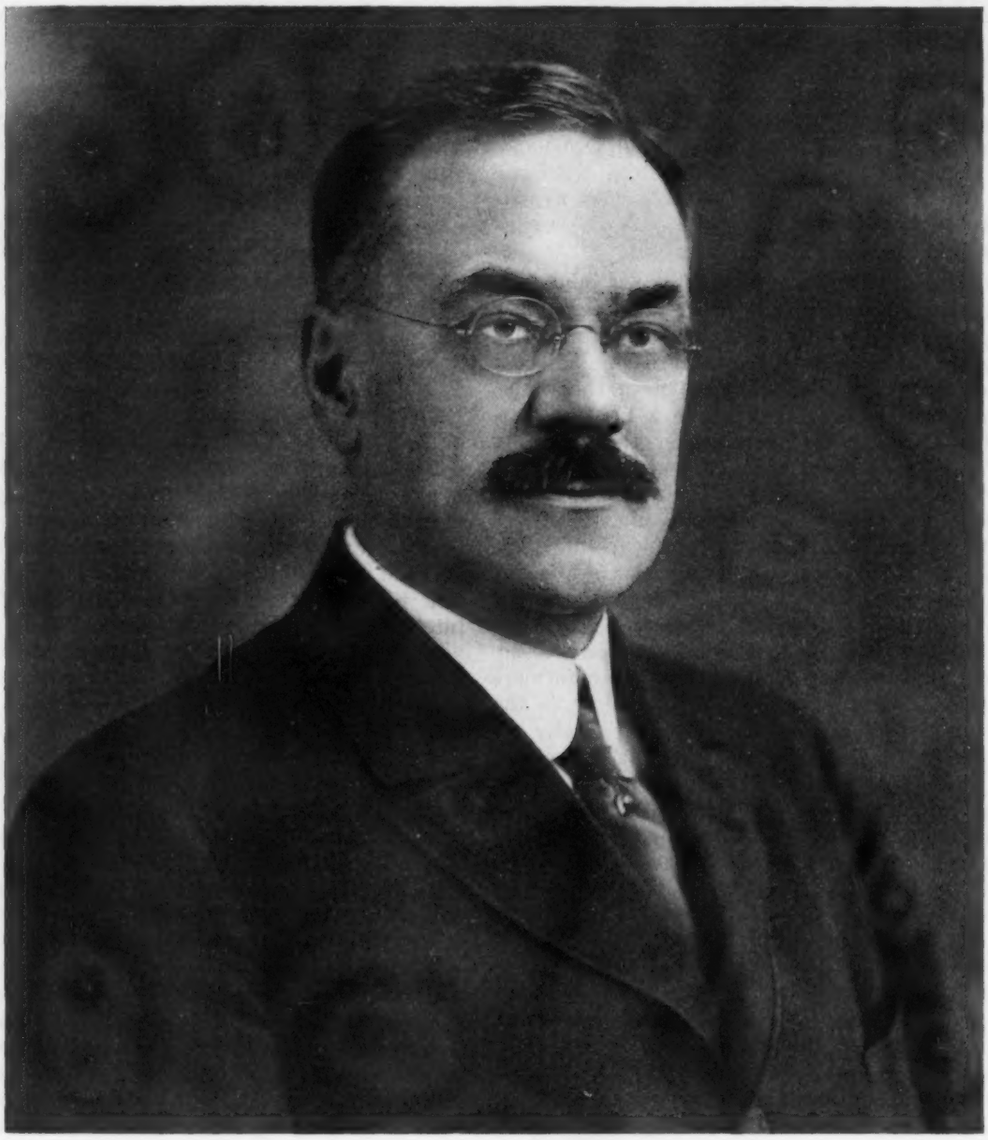
We recommend to operating men particularly a study of the conclusions outlined by Mr. Roper, together with his suggestions for lightning-arrester specifications. These may be said to form the basis for a complete study of the average alternating-current distribution system. Further experience would be desirable to show whether an increased density of arresters would prove equally effective in protecting underground cables up to 25,000 volts from trouble at the cable pole, as Mr. Roper suggests in his report.

Standardizing Electrical Symbols

ELECTRICAL symbols constitute a sort of sign language which engineers and electricians use from day to day. They should be easily intelligible, without ambiguity, and to be of maximum use they should mean the same thing in different organizations and various parts of the country. They would also form a powerful link toward international interchange of ideas if an international code could be decided upon. There have been half-hearted attempts at standardization of symbols in the past, but in our own country there still is a wide variation in practice, in spite of the extent to which the designer, the construction man and the shop man use them. It is important, then, that particular attention should be given to the list printed elsewhere in this issue of some eighty-three symbols which have been tentatively agreed upon for submisson to the International Electrotechnical Congress. We are assured that constructive criticism will be welcomed by the American representatives to that congress, as is, indeed, indicated in the notice which accompanies the symbols.

Considerable work has been done in developing symbols abroad, particularly by the British, Swiss and Italians, and some of their suggestions, though differing widely from American practice, deserve the fullest consideration. For instance, the representation of a transformer winding by a circle, which has long been the practice in Switzerland and Italy, at first may seem revolutionary; but reference to item No. 43 in the list referred to shows at a glance how easily transformer windings may be indicated by this method and how clearly the symbols represent the thing for which they are intended. Interlinking the circles suggests immediately the interlinkage of primary and secondary windings through the magnetic flux. While both methods of representing transformers might be used, one is preferable.

The exact representation of brushes for direct-current machines appears to be open for discussion. It is hoped also that due consideration will be given to American symbols for lightning arresters and to some others which have been added to the proposed list with proper annotations. The list in its present form is by no means complete, but it represents a start in the right direction, and if this much can be agreed upon the rest will follow readily. The adoption of international standard symbols, while entailing some sacrifice all around, should be earnestly supported and will result in smoothing the path for coming generations.



Edwin Musser Herr

An executive-engineer who represents a rare combination of managerial ability and engineering experience and stands at the head of one of the largest organizations in the world producing electrical machinery and steam prime movers

BY FORCEFULNESS of character, faithfulness of trust and the will to undertake and solve a problem, no matter how difficult, E. M. Herr as a young man attracted the attention of the late George Westinghouse, with the result that he is now president of one of the largest electrical manufacturing companies in the world, the Westinghouse Electric & Manufacturing Company. Mr. Herr came into the electrical industry by way of the railroad field. He was born in Lancaster, Pa., May 3, 1860, and as a boy learned to be a telegraph operator. When he had reached the age of sixteen his father suffered financial reverses, and this knowledge of telegraphy enabled the youth at once to find work in which he rapidly forged ahead. Shortly afterward he became a telegraph operator for the Union Pacific Railroad at Deer Trail Station, Col., and a little later was made station agent. His desire to get ahead in the railroad business prompted him to go East for a technical education. He worked his way through the Sheffield Scientific School of Yale University and was graduated in mechanical engineering in 1884. After a year's apprenticeship with the Chicago, Milwaukee & St. Paul Railway, he was until 1890 with the Chicago, Burlington & Quincy, rising to the position of superintendent of tests, then superintendent of telegraph, and finally at the age of twenty-nine division superintendent. He went back to the Chicago, Milwaukee & St. Paul as division master mechanic for two years. There followed two years in the locomotive business in Chicago and then a year in Russia, when, in 1896, he became associated in the electrical industry with George Gibbs as general manager of the Gibbs Electric Company of Milwaukee, Wis. However, shortly afterward he returned to railroading as superintendent of motive power and machinery for the Chicago & Northwestern. After about ten years spent in this work and another year with the Northern Pacific he forsook railroading in 1898 to become assistant general manager of the Westinghouse Air Brake Company. A year later he was promoted to be general manager. This position he held until the summer of 1905, when he was elected first vice-president of the Westinghouse Electric & Manufacturing Company. Six years later he was elected president, an office that he has filled ever since.

While by experience Mr. Herr is essentially a railroad man, still he is an important factor in the electrical industry, guiding as he does the production and engineering effort of an organization that will bill during this fiscal year approximately $175,000,000 worth of engineering products. The electrical industry goes forward in very large measure as a result of the engineering development accomplished by the manufacturers and the general high standards of equipment, and to the men like Mr. Herr who direct the efforts of those progressive institutions the electrical industry owes a large debt of gratitude. Not long ago the Japanese government in recognition of this debt bestowed on Mr. Herr the Order of the Rising Sun.

Clearing House for Five Stations*

To Handle Output of Installations with Combined Rating of 400,000 Hp. Many New Ideas Have Been Incorporated in Echota Substation of Niagara Falls Power Company—Unit Layout Employed—Standard Oil Switches Adapted to Semi-Outdoor Conditions

By J. ALLEN JOHNSON
Electrical Engineer Niagara Falls Power Company

EXTERIOR OF ECHOTA SUBSTATION, SHOWING FIVE SWITCHING BAYS AND INCOMING LINES FROM NIAGARA FALLS GENERATING STATIONS

THE Echota substation of the Niagara Falls Power Company, just off the Niagara River about 2½ miles above the Falls, was purposely located† where it is in order that it might be conveniently connected with the 400,000 hp. in Canadian and American generating stations which it serves as a clearing house and feed Buffalo and the industrial district around Niagara Falls. The Canadian and American systems are also tied together through the circuits of the Buffalo General Electric Company, which receives power from both sources over independent transmission lines. All of the stations are now being operated in parallel, including also the 65,000-kw. steam station of the Buffalo General Electric Company.

The Echota substation of the Niagara Falls Power Company is intended to serve three functions—(1) to subdivide and distribute the power from the new plant, (2) to serve as a clearing house for the output of the five generating stations, aggregating 400,000 hp., and (3) to act as a future stepdown transformer station.

Inasmuch as the primary function of this station is to distribute the power of the new plant, it was decided to preserve the unit arrangement in its construction. The station was accordingly laid out in units of a nominal capacity of 32,500 kva. Five of these units were constructed, three for the new plant and two for interconnection with other generating stations. A control building containing the switchboard apparatus was also erected. The general wiring diagram shows the arrangement of the main circuits; the physical layout of the structure is similar to that of the diagram. The general scheme is that of a main tie bus running lengthwise of the building with the unit lateral buses joining it at right angles. In this manner the over-all length of the building was very materially reduced and the spacing between units kept down to just about that which will later be required for the step-down transformers, specifically 26½ ft. (8 m.).

The prime consideration in the general layout of this station was provision for growth. The various elements of the structure are so placed that each one is capable of almost unlimited extension without interfering with the others; that is to say, each of the power units can be extended, the number of such units can be increased, and the length of the control building which houses the switchboards can also be increased accordingly, without interference with one another.

The five units or bays and the control building are connected at one end by a narrow building or passageway which contains the incoming line protective equipment and serves as a distributer for the control wiring, piping, etc., and as a means of access between the control building and the several unit bays. The main operating portion of the station is concentrated on the second floor, where the oil switches with their "disconnects" and the control room are. There is little or nothing on the third floor which demands operating attention.

The ground floor contains current and potential transformers and feeder disconnecting switches which require attention or manipulation but seldom. Upon each of the unit bays is a subway for distribution of cables. This connects at each end with longitudinal subways.

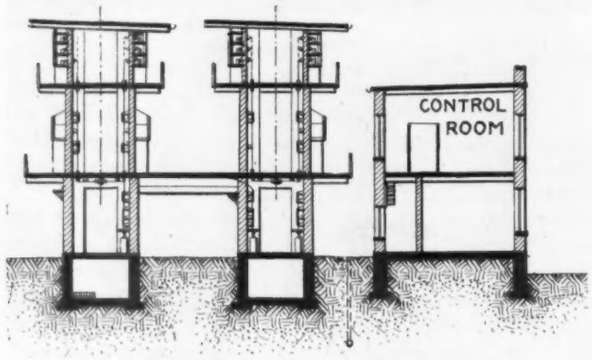
Starting from the control room, the first two bays are intended to provide for the receiving and distribution of power from station No. 3, Hydraulic plant. The other three bays are primarily for the distribution of power from the three new units, and into each of two of these bays is also connected an overhead circuit from the Niagara plant over which the flow of power is likely to be in either direction.

*Sixth and last installment of a symposium on the 100,000-hp. extension to station No. 3 of the Niagara Falls Power Company. (See Sept. 18, Oct. 2, Oct. 16, Oct. 23 and Oct. 30 issues of the ELECTRICAL WORLD.

†See page 875, Oct. 30.

A radical departure from the usual station construction is the placing of all oil circuit breakers on the outside of the building walls; in other words, the main bus and switch structure walls are utilized as the walls of the building, all high-tension connections being upon the inside, where they are thoroughly housed and protected against the elements, and the oil switches upon the outside, where explosions and oil fires can do a minimum of damage. Galleries are provided on the outside for access to the oil switches, which are protected from the weather by suitable housings.

As this station is a very important one in the system, serving, as it does, as the general point of concentration for the output of the five contributing generating stations aggregating 400,000 hp. in capacity, great care was taken in its design to minimize to the greatest possible extent the hazards inherent in the operation of such a station. To this end the different electrical elements of the structure are separated and isolated to the greatest possible extent. In the first place, each unit bay is a separate building, as is also the control building. On the outside of the unit bays the oil switches are on one floor, the bus on another. On the inside the disconnecting switches for isolating oil switches are on one floor and the potheads for outgoing

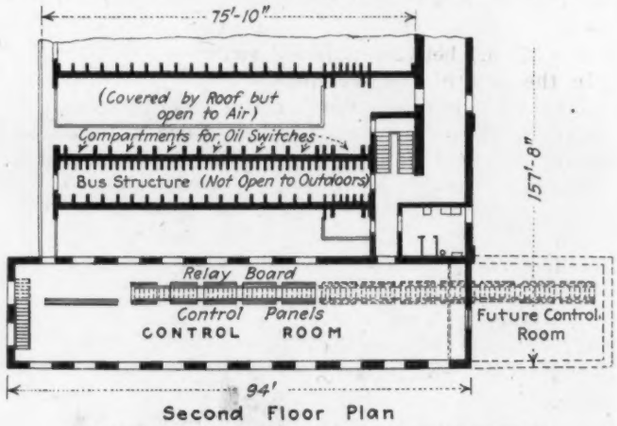


LONGITUDINAL SECTION OF ECHOTA SUBSTATION, SHOWING TWO BAYS AND CONTROL ROOM

cable feeders are on another. The main and reserve buses are completely isolated from each other. Wherever the connections pass through walls or floors substantial porcelain bushings are used, sealed with cement compound so that there is no possibility of an arc being carried through the walls or from floor to floor. All phase connections are separated by brick and concrete barriers and are completely covered by compartment doors except where ventilation outlets are provided, so that accidental contact is virtually impossible.

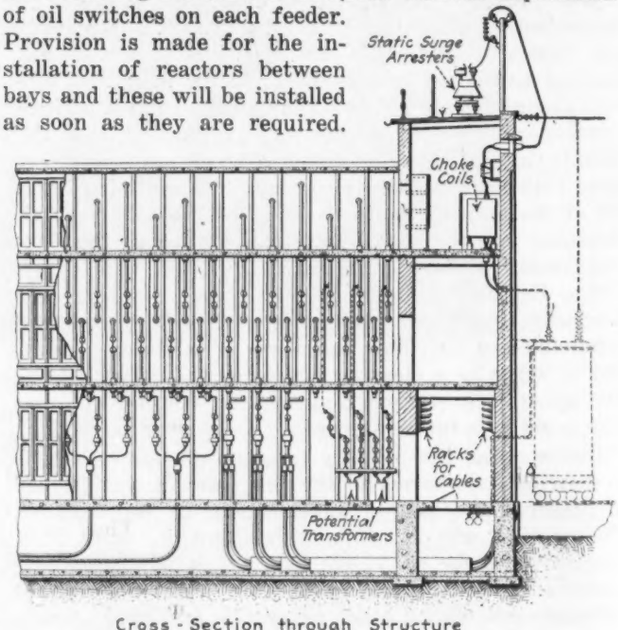
Arrangement of Circuits.—Each incoming line, consisting of two parallel circuits, passes first through disconnecting switches, after which the two circuits are combined into one and pass through a set of choke coils for lightning protection. The "disconnects" and choke coils are installed on the third floor of the connecting passageway in brick compartments. The lightning arresters, which are connected immediately outside of the disconnecting switches, are on the roof of the passage.

After leaving the choke coils the leads enter two 1,250,000-circ.-mil lead-covered cables in parallel which pass down the outer wall of the passage to the subway, thence across and up to the first floor of the unit bay. Here they emerge from the cables through potheads and connect to copper bars, which then pass through current transformers. Immediately above the current transformers are disconnecting switches above which the circuit divides, one side going through an oil circuit breaker to the main bus, the other side through a similar breaker to the unit reserve bus. In each bay provision is made for six outgoing feeders. Each of these connects to the main bus through an oil circuit breaker and to the reserve bus through disconnecting switches. The function of the reserve bus is twofold—(1) it serves as a true reserve bus from which all



PLAN OF CONTROL ROOM AND ONE BAY AT ECHOTA

feeders can be supplied temporarily through the reserve-bus switch in case it is desired to clear the main bus for any purpose; (2) the reserve-bus switch serves as a substitute switch for any individual feeder switch which may be out of service. In this manner duplication of the switching facilities is obtained without duplication of oil switches on each feeder. Provision is made for the installation of reactors between bays and these will be installed as soon as they are required.



TRANSVERSE SECTION OF ONE END OF ECHOTA SUBSTATION

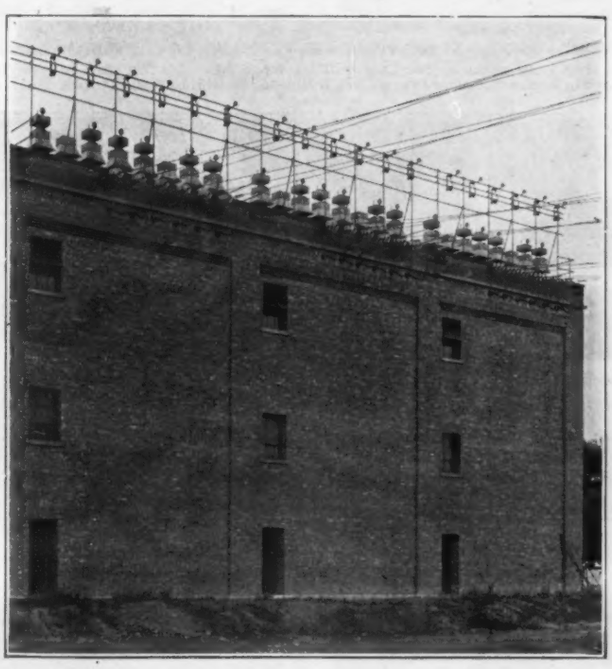
Oil Switches.—Owing to the great importance of this station in the general scheme of distribution, both present and future, it was determined to insure the greatest possible degree of reliability in the oil switches. Accordingly both of the chief manufacturers were asked for a recommendation on this basis, resulting in the proposal of two radically different types of oil switches, namely, the Westinghouse type CO-2 and the General Electric type H-9. Owing to the absence of operating

experience with these switches, it was found impossible to establish definitely the superiority of either one over the other, and it was decided so to construct the station that either one could be used. This was accomplished by slight modifications in the standard assembly of both types, and it was decided to install at the start a number of each type in order that actual operating experience might be had with both.

The General Electric switch is assembled with the oil pots staggered and all connections brought out at the back of the switch with center-to-center spacing of 9 ft. (2.7 m.) between adjacent switches.

In the case of the Westinghouse switches the same spacing of terminals was accomplished by a special design spreading the leads apart above the oil pots before passing through the wall. Thus an arrangement was arrived at whereby both of these radically different types of circuit breaker could be installed in the same width with the terminals equally spaced, so that either type of switch can in future be substituted for the other, should the type installed prove inadequate. Of the five bays, four are equipped with Westinghouse type CO-2 circuit breakers and one with General Electric type H-9.

Safety Features.—Objection has sometimes been made to this type of construction—in which the oil switches and their corresponding "disconnects" are placed upon opposite sides of a solid wall—that it is possible for the operator to open the wrong "disconnects" by mistake. This error may occur in two ways—either he may select the wrong group of "disconnects" or he may accidentally get one "disconnect" on an adjacent oil switch. In this installation both of these errors have been made impossible by the following means:



OXIDE-FILM LIGHTNING ARRESTERS ON OUTGOING LINES AT ECHOTA SUBSTATION

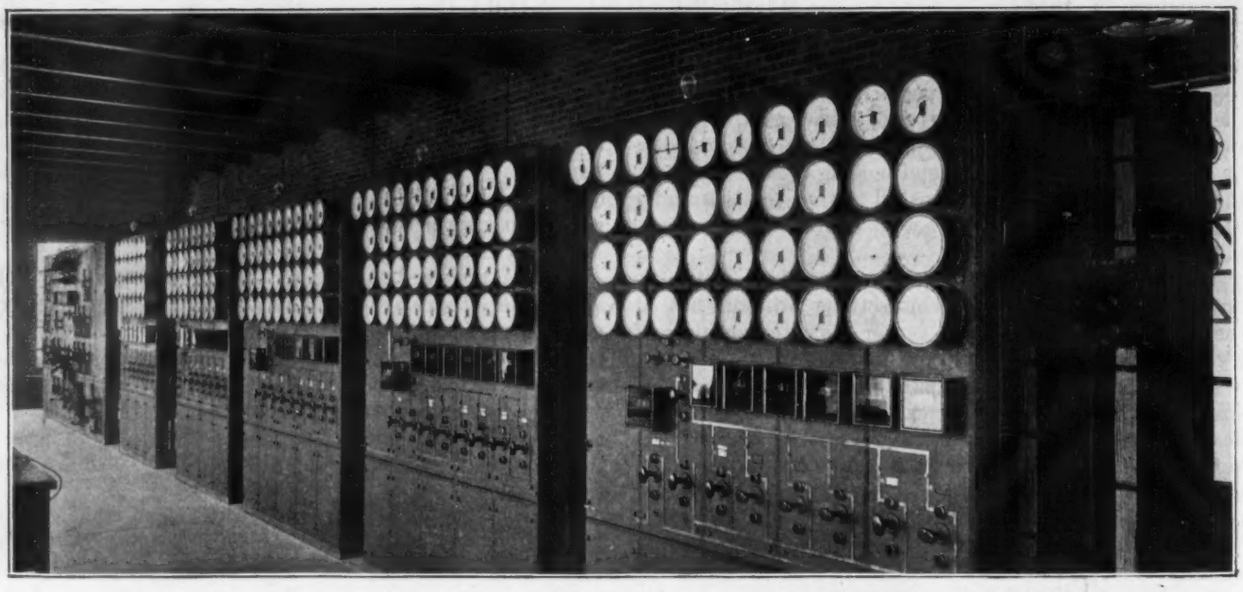
First, the doors covering the disconnecting switches are all hinged at one side and all six doors associated with each oil switch are fastened together by a wooden bar which is hinged to their free edges. Thus, when it is desired to obtain access to the "disconnects" associated with a circuit breaker, all of the six doors are operated together. It is therefore impossible for an operator to obtain access to a "disconnect" of an adjacent circuit breaker.

Second, there is attached to each circuit breaker a shaft extending through the building wall carrying on its inside end a short cross-bar. When this bar is in a horizontal position it engages the edge of one of the disconnecting-switch compartment doors in such a way that the group of doors cannot be opened. This device is so connected to the oil-switch mechanism that it occupies this position when the oil switch is closed. Upon the oil switch being opened the shaft is turned through an angle of 90 deg., so that the crossbar assumes a vertical position, which releases the disconnecting-switch compartment doors. Thus it is impossible for the operator to gain access to the disconnecting switches until the oil switch is in the open position. Provision is made for removing the crossbar by means of a special tool in case it is necessary for some special reason to gain access to the "disconnects" while the oil switch is closed.

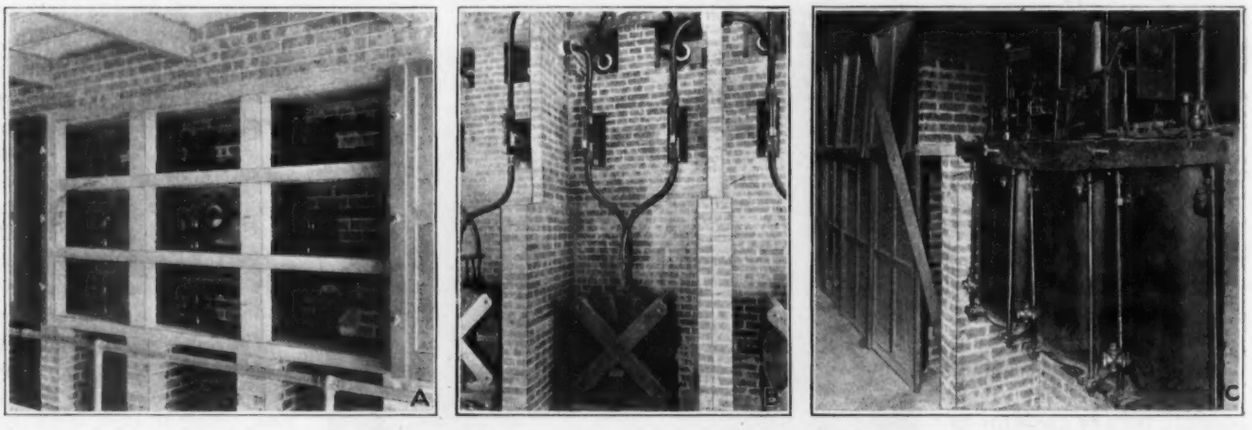
On the reserve-bus side of the disconnecting switch alley, where there are no oil switches, there is, of course, no opportunity to employ this interlocking scheme; but the six corresponding doors are fastened together in the same manner as on the main-bus side. The same scheme of operating the doors in groups is also employed on the lower floor for the compartment doors, giving access to the feeder "disconnects," current transformers and cable potheads.

Control.—As shown by the illustrations, the control building is placed at one end of the series of unit bays and parallel to them. On the lower or ground floor are a small office, an entrance hall, a workshop or store room, a storage-battery room and a motor-generator room, also a longitudinal passageway for control wiring. The second floor is entirely occupied by the control room. The switchboards consist of vertical panels of natural-finished black "Linstun" and are divided into five sections corresponding with the five main bays, in addition to a house-service section. Back to back with the control boards, with a 4-ft. (1.2-m.) aisle between them, are the relay and terminal boards. A group of five panels controls each of the three bays connected with the new units—a bus-tie panel, an incoming-line panel and three fender panels, each controlling two feeders. A similar group of four panels controls each of the other two bays. A dummy bus indicates the connections. The bus-tie panel is equipped with three ammeters, a wattmeter and a reserve-bus voltmeter; the incoming line panel with three ammeters, a wattmeter, power-factor meter, main-bus voltmeter, line voltmeter and synchroscope. Each of the feeders is equipped with three ammeters and a wattmeter. Each instrument and relay is provided with a complete set of calibrating link terminals mounted upon small panels on the rear of the main panels.

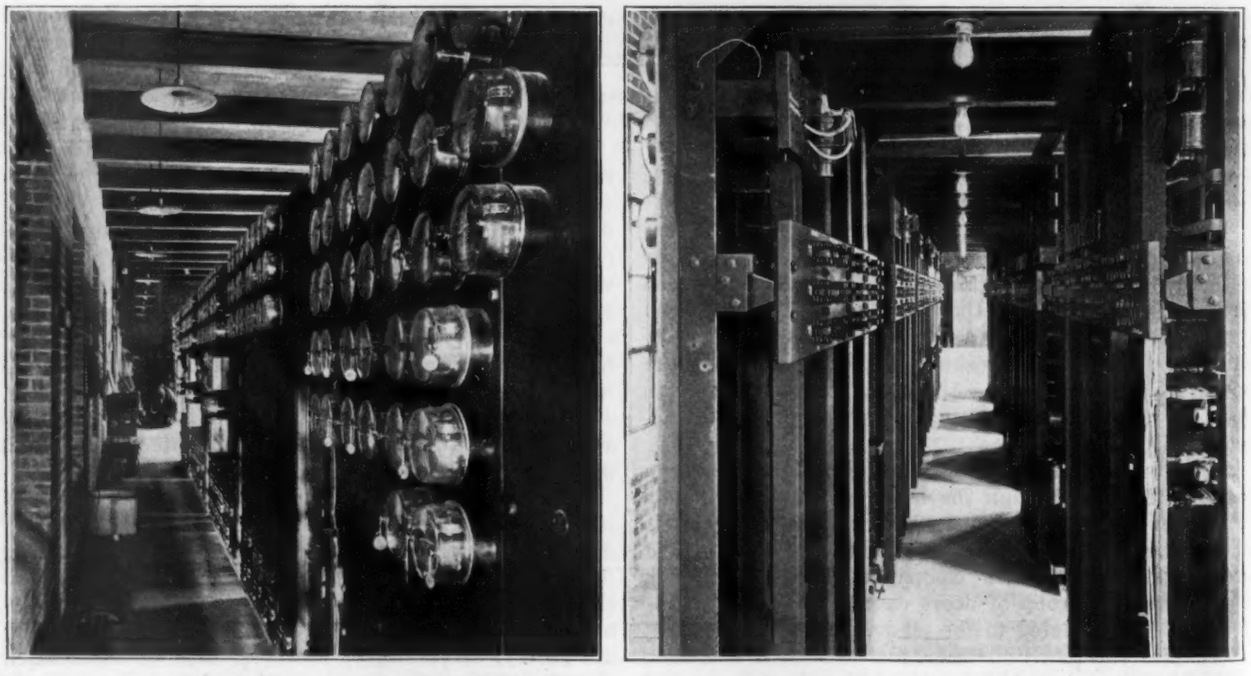
The vertical wiring on the back of the switchboards is carried in troughs made up of two ¾-in. (1.9-cm.) angle sides with "Linabestos" back, the troughs being 3½ in. (8.9-cm.) wide. After the wiring was completed these troughs were equipped with removable sheet-metal covers. The advantages of this system of wiring are safety, accessibility, neatness, ease of installation and flexibility. Furthermore, the wires being entirely free from the panels, the latter can be easily removed,



GROUPING OF INSTRUMENTS AND ANNUNCIATORS ARE FEATURES OF CONTROL BOARD AT ECHOTA SUBSTATION
The instruments are arranged so that confusion in reading will be avoided. At the top of the board are lamps and below the instruments are annunciators which indicate switches which open automatically.



A—TYPICAL SECTION OF A BUS COMPARTMENT. B—CHOKE COILS IN SERIES WITH OUTGOING LINES AT ECHOTA SUBSTATION. C—ONE TYPE OF CIRCUIT BREAKER EMPLOYED AT ECHOTA



BACK TO BACK WITH THE CONTROL BOARD SHOWN ABOVE ARE THE RELAY PANELS
In the aisle between the control and relay boards are control-wire troughs and test terminals. Normally the troughs are covered, but one is shown open.

if required, by merely disconnecting the wires from the instruments and control devices.

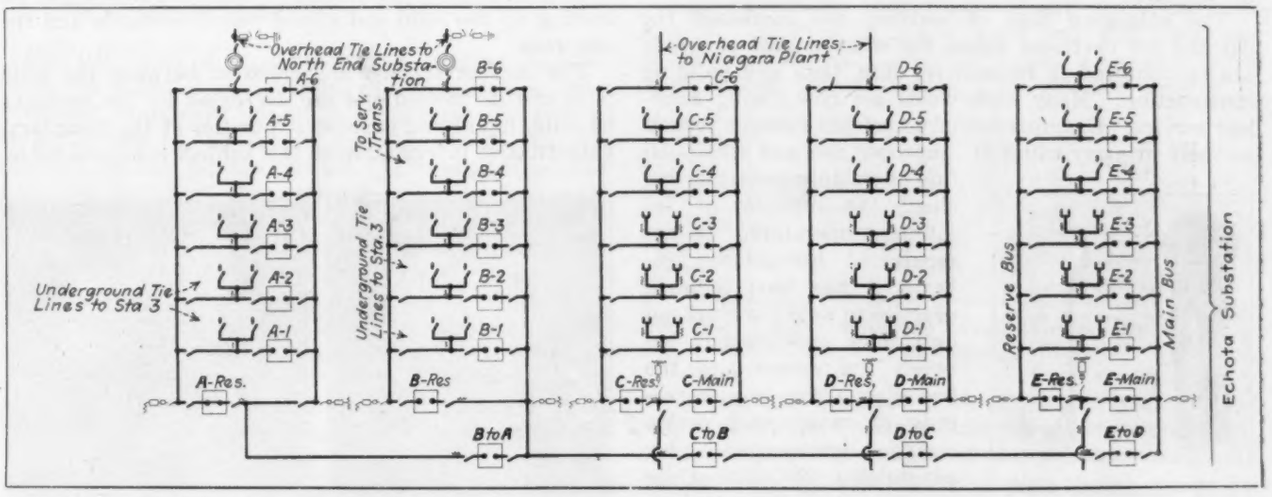
At their point of departure from the board, all control wires pass through terminal links on the lower panels of the relay boards. After leaving the switchboard the control wires are carried in three-conductor cables covered with flame-proof braid and laid in steel pans or troughs mounted one above another on brackets fastened to the wall of the building. Upon reaching the point where the unit bays join the longitudinal passageway the pan for each unit passes through an opening in the wall of the passageway and continues along the outside wall of the bay under the oil-switch gallery. From this pan to the current and potential transformers, oil-switch controls, etc., the control wires are carried in conduit buried in the walls and floors of the structure. By this construction the control wiring is made accessible throughout its entire length, with the exception of the short portion in conduit, and at the same time an enormous amount of conduit work is avoided. The construction is much less expensive and occupies much less space than would the conduit necessary to convey an equal number of wires.

For the operation of the control circuits there are provided two 14-kw. motor-generator sets and a 120-amp.-hr., 220-volt storage battery. The control is normally carried on one of the motor-generator sets and the battery held as a reserve.

Relay Protection.—The incoming lines from the new generating station are each equipped with overload, ground and reverse-power relays. The overload relays are arranged to trip both the main and reserve-bus circuit breakers, but the reverse-power relays trip only the main-bus switch. At present the reverse-power relays are Westinghouse type CR, but it is proposed to substitute for these type CW relays so connected as to operate on low power factor, lagging current feeding from the substation toward the generating station. This is for the purpose of tripping the line switch in case of the accidental loss of the field of the generator and also to enable the line switch to trip on less than full-load current in the reverse direction. The bus-tie switch is equipped with overload relays. Feeder switches are relayed in two different ways, according to the nature of the feeder supplied. In certain cases where a feeder consists of four parallel cables split-conductor protection is provided between the two pairs of cables by means of suitably connected current transformers and low-current relays. In other cases ground relays are installed, connected in the current-transformer neutrals. Overload relays are also installed on all feeders. All relays are of the Westinghouse induction type, the 5-amp. size being used for overload and the 1-amp. size for differential and ground protection.

A somewhat unusual feature in connection with the relay system is the installation of annunciators on the switchboard with the drops connected in series with the tripping circuits of the various relays. By this means it is possible to know at once upon the tripping out of a circuit breaker just which relay was responsible. This immediately gives an indication of the nature and in certain cases of the location of the trouble. It also furnishes the means of keeping tabs on the operation of the relays. Although the station has been in operation only a few months, the value of this feature has already been amply demonstrated.

In the equipment of this station the Westinghouse Electric & Manufacturing Company furnished all of the switchboards and all of the oil switches with the exception of those for one unit bay, also current and potential transformers, choke coils, motor-generator sets and storage battery. The General Electric Company furnished oil switches for one bay and the lightning arresters. Bus supports and disconnecting switches are of the "Franklin" design manufactured by the Electrical Development & Machine Company.



SCHEMATIC CONNECTIONS OF SWITCHES AT ECHOTA SUBSTATION, SHOWING UNIT LAYOUT AND LINES FROM THE HYDRAULIC STATION EXTENSION AT THE BOTTOM

The design and construction of this development were undertaken and largely carried out under the stress of war conditions. The design was in many instances influenced by these conditions, and many possible refinements were doubtless omitted owing to lack of time and men to carry them out. In spite of these conditions the results have been satisfactory as witnessed by some months of entirely successful operation.

The writer desires to express his appreciation of the hearty co-operation accorded him by the manufacturing companies and all those who furnished materials for the work, and also of the work of his staff, which made up in loyalty and enthusiasm what it lacked in numbers. Especial credit is due to his assistant, R. T. Henry, to whose versatility and practical genius are due many of the details of design as well as their application.

Overhead Arc Welding

Welding Overhead Surfaces Entirely Practicable if Operator Understands Principles—Tests of Finished Welds Show Tensile Strength Comparable to Ordinary Downward Welding—Training of Operators in Overhead Work

By O. H. ESCHHOLZ
Material and Process Engineer Westinghouse Electric & Manufacturing Company

A UNIQUE and important property of the metallic electrode arc-welding process is the ability to deposit metal at will either on a flat (downward), vertical or overhead surface. Under the extreme condition of overhead deposition, when the force of gravity is opposing metal transfer, greater manipulative skill is required than when gravity partly or completely assists deposition, as in vertical or downward welding. The degree of skill required for overhead welding, however, is not impossible of attainment when the operator has been properly instructed in the characteristics and manipulation of the arc.

The enlarging field of welding has increased the demand for overhead welds, the most typical of which are encountered in locomotive, ship, tank and building construction. Many such welds are now giving excellent service. Examination of occasional failures reveals as their primary cause an improper use and manipulation of welding materials due chiefly to inferior or indifferent operators. In the repair of locomotive fireboxes it has been common practice to weld the overhead butt joint autogenously between the crown and the flue sheet. The service records of many such welds clearly demonstrate the adaptability and value of the arc process. Nevertheless, owing partly to the greater skill required and partly to the characteristic exaggerated conception of ability possessed by undeveloped welders, unsatisfactory fusion may result when adequate supervisory control is lacking. Overhead deposition is chiefly dependent upon arc phenomena overcoming gravitational force acting on the material of the pencil electrode. The facility with which deposition is accomplished is a function of arc current and arc length, as well as choice of electrode diameter and electrode material.

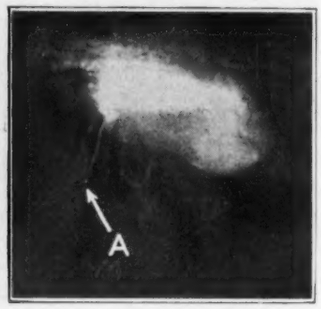
FIG. 1—LIQUEFIED GLOBULAR END OF WIRE ELECTRODE

Note the relatively smooth surface and solid metal in section. The retaining force is determined by size of globule, area of contact between liquid and solid metal and intensity of the forces of cohesion and surface tension.

Upon establishing an arc between an overhead surface and a suitable wire electrode the material at each arc terminal is liquefied. The metal at the positive or plate terminal forms a pool, while that at the wire or negative terminal develops rapidly into a globule.* Fig. 1 shows the appearance of the surface and section of a globule formed on the electrode end. This globule, however, is too large to facilitate deposition, that shown in the arc photograph (Fig. 2) being more typical of good practice. To convey this globule to the plate the lifting force must exceed the retaining forces of gravity, cohesion and surface tension at the wire perimeter. Obviously the problem of transferring the globule may be simplified by decreasing the forces tending to retain the globule on the electrode end.

By producing only small globules the weight of liquid metal may be held to a low value. As the size varies, within limits, with the arc length, the maintenance of a short arc of from $\frac{1}{16}$ in. to $\frac{3}{32}$ in. (1.6 mm. to 2.4 mm.) will therefore insure a controllable globule weight. Other factors determining the magnitude of the total retaining force are the unit surface tension, unit cohesion and the contact area between the liquid globule resting on the solid end of the pencil electrode and the electrode.

The surface tension and cohesion between the solid wire and its molten end are decreased by the presence of solid, liquid and gaseous impurities at the boundary. Quantitative information on this subject is not available.



FIGS. 2 AND 3—APPEARANCE OF ARC STREAM, DEPOSITED MATERIAL AND ELECTRODE END

In Fig. 2 is shown a short arc ($\frac{1}{16}$ in.). The globular end of the electrode as well as the layer of deposited metal can be seen. With the long arc ($\frac{3}{32}$ in.) of Fig. 3 no deposited metal is evident.

Experience, however, has shown that these forces are reduced by the phenomena occurring when small quantities of iron oxide, iron carbide, manganese, etc., and occluded gases are present in the electrode during the deposition process.

The total surface tension and the total cohesive force are proportional to the area of contact between the liquid and solid or plastic metal. It is obvious that these decrease with the diameter of the electrode and also with the total energy developed, and therefore with the arc current. The facility with which the electrode surface becomes "wetted," thereby affecting the contact area, varies with its analysis, melting temperature, physical properties of the surface and the current density. A satisfactory evaluation of the importance of each of these factors has not been made, although it is well known that different types of electrodes employed for downward deposition vary greatly in their "wetting" action and therefore in their characteristic retaining force and ease of overhead deposition.

From this analysis it is evident that when the super-

*"Metal Deposition in Arc Welding," ELECTRICAL WORLD, June 26 and July 10, 1920.

visor determines the material, size of electrode and welding current to be used the only variable affecting the magnitude of the retaining force controllable by the operator is the arc length. Skill in the maintenance of the proper arc length may be readily developed, while a check on its continuous employment may be had by the meter indication of arc voltage or the ringing of a buzzer connected across the arc when the maximum permissible arc length has been exceeded.

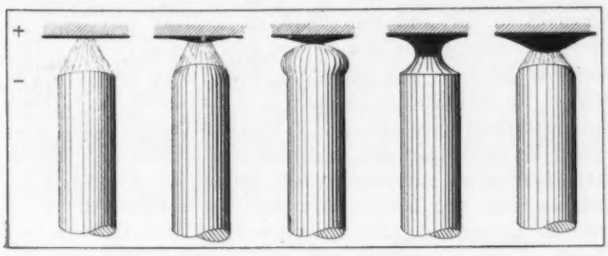
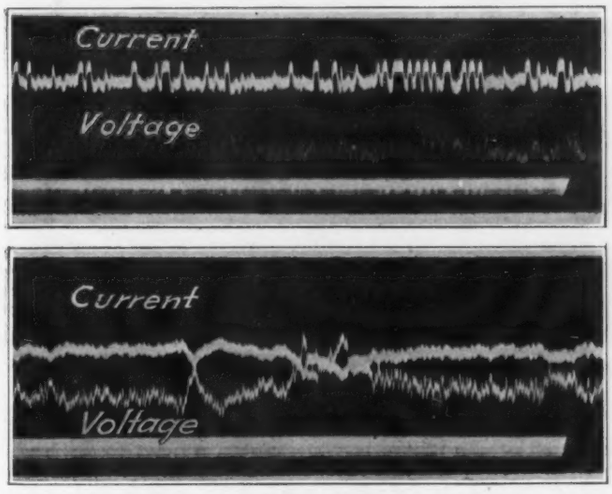


FIG. 4—SEQUENCE OF DEPOSITION PHENOMENA IN OVERHEAD WELDING

Duration of cycle from 0.64 second to 0.03 second, depending on electrodes, current, arc length, etc.

The lifting force is, comparatively, a fixed quantity, since the material and thermal characteristics of most overhead joints vary but little. The total lifting force is a function of the surface contour and of the area puddled by the positive crater. It is also dependent upon the "wetting" characteristic which facilitates the adhesion and spread of the electrode globule on making contact with the puddled surface. The rate at which the plate metal absorbs heat energy from the deposited metal determines the rate of congealing of the electrode metal and therefore is a factor in determining the magnitude of the lifting force. Heating an overhead joint locally helps to start layer deposition, since it facilitates the initial production on a cold plate of a "wetted" surface to which the globule must be attached



ON VOLTAGE AND CURRENT

In the upper figure is shown the effect of a short arc, the current peaks indicating short-circuiting of the arc stream by globule growth and subsequent deposition. The absence of these short-circuit peaks is evident in Fig. 6, which shows the effect of the long arc. No metal is deposited in the latter case.

by the forces of surface tension and adhesion. However, if the joint temperature is uniformly increased to a high value, deposition will be retarded since the rate of congealing of deposited metal is decreased.

The cycle of deposition appears to be as follows:

1. Metal at each terminal is liquefied upon striking an arc.
2. The molten electrode end assumes an approximately spherical form, due to the well-known phenomena of surface tension causing a fluid material to contract into the smallest volume.
3. This globule enlarges, with continued application of energy, until with the aid of electrode manipulation its upper surface is brought into contact with the overhead pool, thereby short-circuiting the arc stream and causing the lifting forces to act upon it.
4. Forces of surface tension and adhesion at the contact area between the overhead plate and the globule cause the globule to change its form and spread over the plate surface.
5. As the metal spreads, the area in contact with the plate increases and therefore the lifting forces are also increased, causing an acceleration in metal transfer. These forces act until the globule is lifted off the wire electrode end, when the short circuit is broken and the arc re-established.

This deposition sequence is shown graphically in Fig. 4. In Figs. 2 and 3 short and long arcs are shown respectively. Bare mild-steel electrodes were used for the deposit tests. The globular growth is

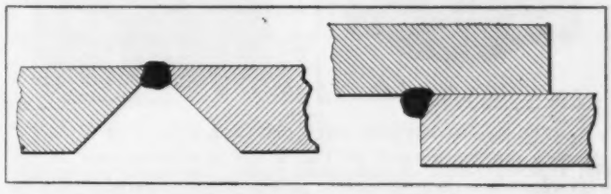


FIG. 7—THE FIRST DEPOSITED LAYER SHOULD FUSE TOGETHER ABUTTING MEMBERS AS SHOWN

visible on both electrode ends. However, the short arc employed in Fig. 2 permits, with the electrode manipulation, bringing the surface of the globule readily into contact with the plate during the period when the retaining force is small. The layer of deposited metal as well as the arc crater are clearly visible in the illustration.

To bridge the arc gap shown in Fig. 3 a larger globule is required. The size of this globule produces a retaining force which exceeds the lifting force and thereby prevents metal transfer. With continued application of energy and the maintenance of such a long arc, the accumulating liquid metal either drops off the end of the electrode or flows down its side. The striated appearance of the electrode surface in Fig. 3 is caused by the metal flowing from the end.

In Figs. 5 and 6 are shown instantaneous variations in arc current and arc voltage when holding the short and long arcs shown in Figs. 2 and 3. The instant at which the globular growth short-circuits the arc is identified when the arc-voltage record drops to nearly zero and the arc current attains maximum value. The frequency with which this occurs indicates that approximately twenty-five globules are being deposited each second. In Fig. 6 the voltage and current records indicate the normal variation in arc length as determined by electrode manipulation and globular growth, but they do not indicate contact between the plate and the electrode as shown in Fig. 5. The deposition rate is therefore nearly zero, only metal being deposited by the condensation of a small amount of metallic vapor. As

the amount deposited is small it is not visible on the plate surface shown in Fig. 3.

It is preferable to select candidates for overhead welding from operators who are competent downward welders.†

The first step in the training of such welders consists in demonstrating and explaining phenomena of metal transfer. The second step involves the change in deposition facility with change in arc length, arc current, electrode diameter and electrode material. It will be found that the usual skilled downward welder is quick to appreciate and recognize the bearing of these factors on overhead deposition. Deposition skill should first be developed on a vertical surface, then on a plate inclined 45 deg., and finally on a flat over-

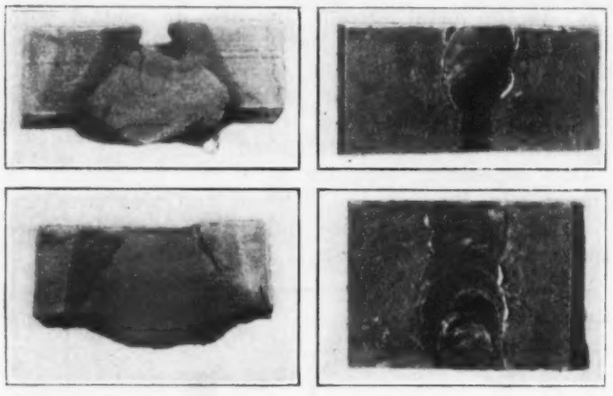


FIG. 8—INCOMPLETE AND COMPLETE FUSION OF V

Section through zone B of Fig. 9 and a surface view of the weld showing result of incomplete fusion. In lower photograph is shown section through zone C of Fig. 9 and a surface view of the section where fusion was good.

head surface, with the operator holding in each case a short arc $\frac{1}{16}$ in. to $\frac{3}{32}$ in. (1.6 mm. to 2.4 mm.), or 18 volts to 20 volts, with $\frac{1}{8}$-in. (3.2-mm.) diameter bare mild-steel gas-free electrodes and an arc current of 100 amp. The metal should be deposited in continuous layers on a $\frac{1}{4}$-in. (3.2-mm.) thick plate. The employment of a light-weight electrode holder, designed to protect the operator from falling hot metal, as well as to remain cool in service with a minimum cable drag while holding the electrode perpendicular to the surface to be welded, will be found both to expedite and greatly facilitate overhead deposition.

Electrodes vary greatly in their overhead deposition characteristics. Metal may be deposited with some types at the rate of two globules a second; with others this may be as high as thirty a second. The penetration of the deposited metal into the plate appears, however, to decrease somewhat with increase in globular deposition rate. Owing to the facility with which the surfaces of some types of electrodes become "wetted," the globular retaining forces are so large that overhead deposition is impracticable. In view of these differences in deposition performance, the operator should become familiar with the characteristics and manipulation of a variety of bare and covered electrodes available on the market. To obtain fusion it is necessary to secure penetration, crater depth, minimum overlap, etc., as in the case of downward deposition.‡

The use of a low current, of the order of 100 amp., produces a slow and easily controllable globular growth and deposition. After the operator succeeds in developing deposition control under this condition, arc current and electrode diameter should be gradually increased to values approximating those employed for downward welding. The operator, however, will then find that an electrode length of only 6 in. (15 cm.) (approximately) will be readily deposited, the deposition of the remainder becoming increasingly difficult owing to the fact that the hot, inclosing convection currents of air and arc gases, as well as the internal energy consumption due to the resistance of the wire, serve to preheat the electrode and cause the melting rate of its terminal to increase. It has been found that the electrode may be kept comparatively cool, and therefore maintain an approximate constant melting rate throughout the deposition period, by giving it as well as the arc terminal either an oscillating or a circular movement. Such a movement disturbs the hot sheath of gas in contact with the electrode and permits the influx of cooling air. By employing this manipulative expedient it is possible to deposit the metal continuously from 12-in. (25.4-cm.) lengths of electrodes $\frac{1}{8}$ in., $\frac{5}{32}$ in. and $\frac{3}{16}$ in. (3.2 mm., 4 mm. and 4.7 mm.) in diameter when employing arc currents of respectively 125, 150 and 175 amp.

OVERHEAD WELDS

These are commonly butt or lap joints. In designing a structure perference should be given to the lap joint because it is more easily welded. The overhead butt joint is prepared similarly to the downward butt joint. It is usually scarfed from 60 deg. to 90 deg. and a "free distance" of from $\frac{1}{16}$ in. to $\frac{3}{32}$ in. (1.6 mm. to 2.4 mm.) separates the adjacent sections. To maintain these in place, the plates are tacked together at intervals of 2 ft. (0.61 m.), when the rigid assembly system is used, and the metal deposited in layers by

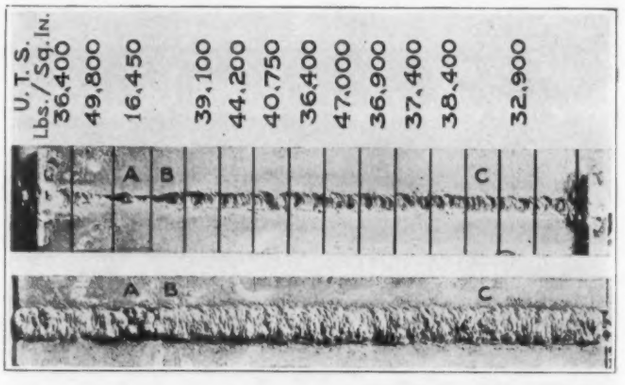


FIG. 9—APPEARANCE OF TOP AND BOTTOM OF OVERHEAD BUTT-WELDED PLATES

This weld was made after an experienced downward welder received several days' training in overhead welding. Bare mild-steel electrodes of $\frac{5}{32}$-in. diameter were used with a current of 125 amp. Tests were made to determine the ultimate tensile strength by cutting strips from the plates as shown by the markings. The average strength was 45,600 lb. per square inch for one test and 39,450 lb. per square inch for another. Zones B and C are shown in detail in Fig. 8.

the "step-back" method to avoid excessive heating of the plate and consequent high internal cooling stresses.

The successful welding of an overhead butt joint is chiefly dependent upon the completeness with which the initial layer fuses together the apex of the V. In Fig. 8 are shown sections through correctly fused abutting members and it illustrates the characteristic

†"Training Arc Welders," ELECTRICAL WORLD, Sept. 27 and Oct. 4, 1919.

‡"Fusion in Arc Welding," *Transactions* A. I. E. E., March, 1919.

appearance of a section wherein the first layer failed to fuse the abutting plate edges. Such failure may be attributed to the indifference of the operator in controlling arc length and applying deposited metal, too low an arc current, and either too great or too small "a free distance." An inspection of the surface frequently reveals poor workmanship and suggests the cause.¶

It is now recognized that in downward welding, layer and tier deposition of metal give the most satisfactory joint characteristics. This is due to the fact that each deposit is reheated by the superposed metal and then cools at a slower rate than if exposed fully to the atmosphere. This partial annealing serves to refine the grain and relieve internal cooling stresses. The writer therefore wishes to advocate a similar procedure for overhead welding, particularly as it is now general practice to fill the area between scarfed surfaces completely as the welder progresses along the joint. It is known that this procedure increases internal stresses, decreases ductility, and tends toward warping of the structure.

The plates shown in Fig. 9 were welded after the operator had had but two days' practice in overhead deposition. After several days' further practice the same operator butt-welded ¼-in. (6.4-mm.) and ½-in. (12.7-mm.) boiler plates overhead, scarfed to 90 deg. The data show that a conscientious and properly instructed operator will produce overhead welds having characteristics comparable with those made in more favorable positions and there is a uniformity of tensile strength throughout the length of the weld.

¶"Inspection of Metallic Electrode Arc Welds," *Mechanical Railway Engineer*, July, 1919.

Power Service for a Middle West Section

Survey in Western Pennsylvania and Eastern Ohio by Power Section of War Industries Board Indicates an Aggregate Power Peak Demand During 1918 of 568,000 Kw. and a Total Central-Station Output in This District of 2,440,000,000 Kw.-Hr.—Estimated Increased Peak Load of 1,000,000 Kw. by 1927

By CAPT. LYLE A. WHITSIT
Assistant Engineer Division of Power and Transmission, Super-Power Survey

DURING the war period of 1917 and 1918 a serious power shortage developed in the western Pennsylvania and eastern Ohio districts, and steps to remedy this condition were initiated by the Power Section of the War Industries Board. This investigation resulted in a program for the addition of 300,000 kw. of new equipment to be placed in operation during 1919. The power shortage was somewhat relieved by co-operation between the various central-station systems and by co-operation also with the customers. The occurrence of the influenza epidemic, which depleted the labor resources of the manufacturing companies, and the signing of the armistice in November, 1918, prevented the accumulation of a power demand in December of that year that might have been beyond the capacity of the central stations.

The total generator rating in the power plants of the district, including the cities of Cleveland, Lorain, Akron, Warren, Youngstown, Alliance, Canton, Massillon, Mansfield, Newark, Coshocton, Pittsburgh, Connellsville, Wheeling, Windsor and others, amounted to about 773,000 kw. on the first of January, 1919. The total output from these stations in 1918 was approximately 2,440,000,000 kw.-hr., and the aggregate of the various power-peak demands during 1918 was 568,000 kw. Although these figures indicate reserve capacity, the actual distribution and the interconnection of systems were not such as to relieve the 1918 shortage in the Pittsburgh district.

The plant cost of power, including only coal, labor and plant repair costs, varies in this district from something less than 5 mills per kilowatt-hour to 25 mills in the inefficient central-station plants. The cost of coal delivered, which in 1914 varied from $1.06 to $1.72 per ton, increased to $2.79 and $4.20 per ton in 1918.

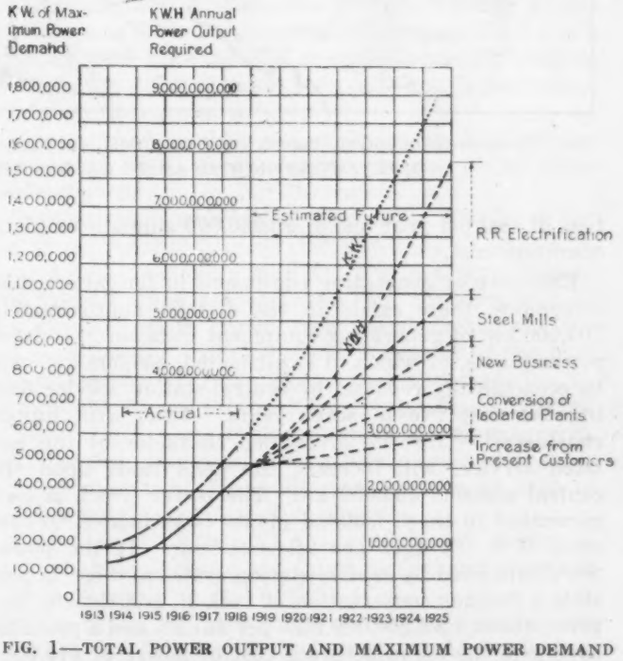


FIG. 1—TOTAL POWER OUTPUT AND MAXIMUM POWER DEMAND OF CENTRAL STATIONS OF WESTERN PENNSYLVANIA AND EASTERN OHIO DISTRICT

Coal consumption per kilowatt-hour generated varied from 1.8 lb. (0.8 kg.) in the efficient plants to 9.2 lb.

*This is an extract from a report on an investigation of the power service of western Pennsylvania and eastern Ohio, which Captain Whitsit, formerly of the Power Section of the War Industries Board, made during the latter part of 1918 and first part of 1919 under the authority of the Power Section, the investigations of which were under the supervision of Frederick Darlington, consulting engineer. Captain Whitsit is now engaged on power and transmission studies in connection with the Super-Power Survey for the Boston-Washington district.

(4.1 kg.) in the older and less efficient plants. There is such a wide variation in the rate of coal consumption and the cost of manufacturing power between the modern efficient plants with units of large rating and those of the older plants with inefficient and small-sized units that great economy can be effected by generating the power of the present inefficient plants by means of an efficient equipment of large-sized units in the power plants which have been contemplated at Windsor, Cheswick, Springdale and elsewhere. If the power now generated by the inefficient plants in the western Pennsylvania and eastern Ohio districts with a coal consumption rate of 2½ lb. (1.13 kg.) per kilowatt-hour, and a power manufacturing cost of more than 5 mills per kilowatt-hour were generated in efficient plants at a coal consumption of 1.8 lb. (0.8 kg.), there is a possible annual saving over 1919 figures of 796,000 tons of coal per year and of $6,950,000 annually in plant operation cost.

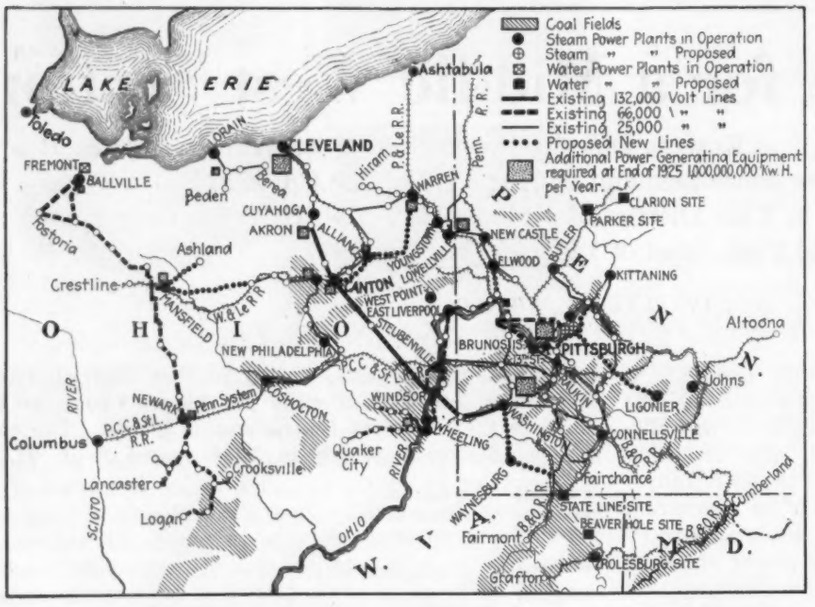


FIG. 2—ECONOMIC POWER PRODUCTION REQUIRES ABUNDANCE OF COAL SUPPLY IN JUXTAPOSITION WITH AMPLE WATER SUPPLY

Exclusive of generating equipment in the larger steel companies, there exists in the district approximately 700,000 kw. of generating equipment installed in isolated power plants, of which, it is estimated, 460,000 kw. may be economically replaced by central-station service during the next five to seven years. This, with proper consideration for the diversified character of the isolated service, will increase the peak loads upon the central systems 205,000 kw. The power which is now generated in these isolated plants is estimated to consume 9 lb. (4 kg.) per kilowatt-hour. If the power were furnished by central-station systems, there is possible a further conservation of coal, in addition to that given above, of 3,250,000 tons per annum and a probable saving in the manufacturing cost of power of $18,000,000 per year.

In addition, it is estimated that there is some 800,000 kw. of generating equipment, including electric, gas and steam power, in the larger iron and steel companies in this district. In view of the fact that steel companies have byproduct fuel and waste heat, it is not probable that more than half of this will ever affect central-station service. This would increase the peak demand by 180,000 kw.

Central stations of this district serve a large industrial manufacturing load. Of their total output some 15 per cent was used for lighting, 65 per cent for power requirements and 20 per cent for trolley service. Load factors of the various systems vary from 38 to 61 per cent, with a weighted average of 49.7 per cent for the district. The average diversity factor is about 45 per cent.

Fig. 1 shows an estimated increase in annual power requirements for the district to and including 1926. It indicates a total increase in the present lighting load of 60 per cent for the five- to seven-year period. It is equivalent to an increase of 10 per cent compounded annually and includes the increased demands of present customers and new lighting business. The increased electrical energy to meet the power-load requirements of present customers is 13 per cent, which is equivalent to an annual compounded rate of 2 per cent. This does not include the energy required to meet the power load of isolated plants which have previously generated their own power but which may reasonably be expected to solicit central-station service within the period named, nor does it include the power requirements of new industrial extensions.

These items were arrived at separately from estimates prepared by the individual companies and aggregate amounts which are equivalent to about 50 to 60 per cent of the present power load. The increased energy requirements for trolley operations are taken as 20 per cent for the period, as being an average between the extremes of 15 and 25 per cent of the 1918 railway load.

On the above assumptions the total peak on the central-station systems for the year 1927 will be 1,100,000 kw., exclusive of requirements from steel companies and for railroad electrification. Adding to this 100,000 kw. for steel company requirements and 200,000 kw. for railroad electrification will give a total estimated peak of 1,400,000 kw. The present installed rating of central-station systems on Jan. 1, 1919, was about 770,000 kw. The present program of the central-station companies will add about 300,000 kw., which is only sufficient to replace the present inefficient equipment, whose operation should be discontinued. Of the 770,000 kw., 170,000 kw. should be considered as reserve capacity, leaving 600,000 kw. available for carrying peak load, which will take a portion of the estimated future peak of 1,400,000 kw. New equipment is required to carry the remaining 800,000 kw.

In order to meet the power requirements for the next five to seven years it is recommended that the program which the central-station systems have started be actively carried out and extended. To produce the cheapest power in this district it is necessary that power plants be located at points where abundance of coal supply is available and an ample amount of condensing water is assured. Fig. 2 shows the location of some of the coal resources as they have been made

evident by existing commercial coal mines. The map also shows, through the principal rivers drawn thereon, the more important sources of condensing water. Some of the rivers are, however, limited by low summer flow accompanied by high-water temperature. The most feasible locations will, therefore, necessarily fall along the Ohio River and its main tributaries. The plants at Windsor and Springdale and the proposed plant at Cheswick meet with these conditions. They are on the Ohio and Allegheny Rivers and have adjacent to the plants coal mines of ample capacity for twenty-five years. Locations next in importance to those on the Ohio and Allegheny Rivers are West Pittsburgh on the Beaver River, Warren on the Mahoning River, points on the Youghiogheny River and Bolivar on the Tuscarawas River. The selection of the latter locations, though less favorable than the former, may be required because of the localized power demands.

This report recognizes that hydro-electric power which is available on the Clarion and Cheat Rivers and other proposed developments in western Pennsylvania, if operated in conjunction with existing steam-power systems, compares favorably at the present time with the production of power in additional steam plants of modern design. With the increasng cost of labor and fuel, which will raise the cost of power at a faster rate in steam plants than it does in hydro-electric plants, future comparisons will be more in favor of hydro-electric plants than at present. It is therefore recommended, in the provisions for generating additional power, that serious consideration be given to hydro-electric power resources. With a peak of 1,400,000 kw., the annual amount of power required is 6,000,000,000 kw.-hr. The top 800,000 kw. of the load curve, which is 57 per cent of 1,400,000 kw., would require 35 per cent of the total power in kilowatt-hours, or 2,100,000,000 kw.-hr.

The Clarion River development will furnish 300,000 kw. of power capacity and 650,000,000 kw.-hr. of power in a year of average stream flow, and the total Cheat River development will furnish 500,000 kw. of capacity and 1,350,000,000 kw.-hr. of power in a year of average stream flow, making a total for the development of these two rivers of 800,000 kw. in capacity and 2,000,000,000 kw.-hr. in a year of average stream flow. With the development of Cheat River power, the increased power requirements in the vicinity of Cumberland, Md., and Fairmont, W. Va., will draw upon this source for some of its power. There are other water powers in West Virginia and western Pennsylvania which may compare favorably with those considered in this report. Information, however, was not available which would warrant making any recommendations regarding them.

In a year of minimum stream flow the developments on the Clarion and Cheat Rivers would furnish only 1,290,000,000 kw.-hr. of power, which is 21½ per cent of the total 6,000,000,000 kw.-hr. It corresponds to 43½ per cent of the top portion of the load curve, or 610,000 kw. In other words, in a year of extreme low water 190,000 kw. of reserved steam capacity would be called upon to make up the deficiency of water power available in a year of average stream flow.

An important fact learned in the operation of the power systems during the war period was the decided advantage afforded by the thorough interconnection and unified operation of central-station systems. This made possible the use of excess capacity in one location or of one system in other locations or systems where there was a scarcity of capacity. It further made accessible reserve capacity in any one system for breakdown and emergency conditions in other systems, thus reducing the total reserve required.

At the present time increased economies in power production are obtained by the construction and operation of units of large capacity with the abandonment of units of small size, or at least using them only for emergency and for peak loads. Reliability obtained in modern transmission-line construction makes possible the realization of other economies obtained by the suitable location of power plants convenient to coal deposits and condensing water. Economies will increase with the increased size of power stations up to a capacity of 300,000 kw. As Pittsburgh has grown to be a great center of industrial manufacturing, so the Ohio River district and its resources furnish the picture of some time becoming an immense center for the manufacture of power whose products will be distributed by transmission lines to meet the requirements not only of western Pennsylvania but also of Ohio and Indiana and westward until they meet the competition of other large super-power plants with equal natural resources in coal and condensing water.

Electrical Symbols Proposed for International Adoption

Complete Set Adopted by Advisory Committee for Consideration at Next Plenary Meeting of International Electrotechnical Commission

AN IMPORTANT step toward the general use of standard electrical symbols was taken at the recent Brussels meeting of the International Electrotechnical Commission. A tentative list of symbols was adopted for consideration at the next plenary meeting of the commission. This list is published on page 972 in full, together with some parallel symbols commonly used in this country which may yet receive favorable consideration when final action is taken.

The proposed symbols are published at this time, by courtesy of the I. E. C., for the purpose of affording ample opportunity for full discussion.

Perhaps the most striking proposal in the list is the use of circles for transformer windings as shown in several items beginning with 39. The idea is completely new to most American engineers, but the simplicity of the diagrams thus drawn recommend themselves for full consideration, both from the viewpoint of the man who makes the diagram and the man who reads it. In items 53, 54, 63 and 67 are alternative proposals inserted by the editor to show what appears to be a simpler symbol than that proposed in the official report of the advisory committee. These alternatives may be said to be representative of American practice.

Beginning with item 21, two symbols are shown in many instances, one for use in single-line and the other for complete wiring diagrams.

As a basis for presenting American practice the paper on symbols by E. J. Cheney, read at the last midwinter convention of the A. I. E. E. and abstracted in the ELECTRICAL WORLD for Feb. 28, was used by our representatives on the advisory committee on symbols. Dr. C. O. Mailloux was chairman of the American delegation as well as being president of the I. E. C., and Dr. P. G. Agnew was secretary.

Electrical Symbols Recommended to International Electrotechnical Commission

(See page 971)

SYMBOLS PROPOSED FOR INTERNATIONAL USE

I-Diagrammatic Elements

1 Two-phase three-wire
2 Two-phase four-wire
3 Three-phase mesh-connected
4 Three-phase star-connected
5 Double three-phase mesh-connected
6 Double three-phase star (zigzag)-connected
7 Six-phase mesh-connected
8 Six-phase star connected
9 Neutral wire brought out
10 Three-phase star-connected with neutral wire brought out

II-Symbols

a-Italian-b-British-c-The circle representing transformer windings has been used by the Swiss and Italians for many years.
d-Thin line is positive-e-f-g-h-American

1 Generating station (thermal)
2 Generating station (hydraulic)
3 Generating station (mixed thermal and hydraulic)
4 Substation (general)
5 Substation with transformers
6 Substation with rotating machinery
7 Substation with battery
8 Substation with rotating machinery and transformers
9 Substation with switch gear only
10 Wooden poles
11 Iron poles
12 Cement poles
13 Line carrying direct current
14 Underground lines
15 Traction lines (optional)
16 Wire crossing in contact or teeing
17 Wire crossing not in contact
18 Group (3 wires) teed
19 Earth connection
20 Earth connection with capacity
21 Generator or motor to be represented by circle with suitable additions, as:-
If no letter is inserted in the circle the machine is understood to be a generator
Direct current motor
22 Field or other winding
23 Radial brush or tangential brush, as preferred by each national committee, thus:
24 Generator or motor with series excitation
25 Generator or motor with shunt excitation
26 Generator or motor with compound excitation
27 Alternating-current generator, single-phase
28 Alternating-current generator, two-phase
29 Alternating-current generator, three phase
30 Alternating-current generator, three-phase mesh-connected
31 Alternating-current generator, star-connected
32 Alternating-current generator, star-connected, neutral wire brought out
33 Asychronous motor
34 Synchronous motor
35 Series Alternating-current motor
36 Repulsion motors
37 Machines coupled, for example:-motor-generator-two separate machines coupled
38 Rotary converter
39 Alternating-current transformer (general)
40 Current transformer
41 Pressure transformer
42 Three-phase transformers:
Mesh-mesh
Mesh-star
Star-star
43 Three single-phase grouped
44 Auto-transformers
45 Battery (general)
46 Primary cell
47 Secondary battery
48 Incandescent lamps
49 Arc lamps
50 Busbar
51 Spark gap (general)
52 Lightning arrester (general)
53 Horn-gap arrester
54 Electrolytic arrester
55 Condenser
56 Contact
57 Variable condenser
58 Inductance (general)
59 Variable resistance
60 Variable air-core inductance
61 Iron-core inductance (choke coil)
62 Liquid resistance
63 Electromagnet
64 Switch
65 Air-brake switch
66 Multiple-pole switch
67 Two-way switch, single-pole
68 Two-way switch, double-pole
69 Oil-immersed switches
70 Ammeter
71 Voltmeter
72 Wattmeter
73 Frequency meter

Lightning Protection of 4,000-Volt Lines

That the Density of Lightning Arresters on an Electrical Distribution System Is Far More Important than the Type of Arrester Is Shown by Investigation—Experience Does Not Bear Out the Conclusions Drawn from Laboratory Tests of These Arresters

ALTHOUGH it has generally been the opinion of operating men that distribution systems with a high density of transformers—that is, a large number per square mile—will be subject to more frequent interruptions due to lightning trouble than will systems with proportionately fewer transformers, tests carried out on the extensive 4,000-volt, 60-cycle distribution system of the Commonwealth Edison Company indicate that such is not the case where each transformer is protected by a lightning arrester. Curves have been plotted to show that where there were 100 transformers and arresters per square mile the average number of burned-out transformers amounted to 1.67 per cent per annum, whereas in areas where the density reached 200 the burn-outs reached only 0.5 per cent, an actual reduction from seventeen to ten burn-outs. The importance of the density of arresters on this system was brought out by D. W. Roper in a paper entitled "Studies in Lightning Protection on 4,000-Volt Circuits—II,"* presented at the meeting of the American Institute of Electrical Engineers held in Chicago yesterday. Mr. Roper also showed that the same principle applies to cable poles where underground cables are connected to the overhead system, namely, that there should be a high density of arresters in the vicinity of these poles in order to keep the underground system comparatively free from lightning interruptions. Laboratory tests of arresters fail to take account of these considerations.

Characteristics of the System Investigated

The system of distribution on which these investigations were made is a four-wire, three-phase installation, with the neutral grounded only at the substations and with 4,000 volts between phases. Single-phase transformers are used almost exclusively and are connected between the phase and neutral wires. Power and lighting customers are supplied from the same primary mains, but the very large customers are connected to a 12,000-volt system. The feeders are all No. 0 wire and the mains No. 6. About 85 per cent of the feeders and 15 per cent of the mains are underground, while about 99 per cent of the transformers are on poles and the rest in manholes or vaults. At single transformer installations a 2,400-volt arrester is connected to the same phase wire as the transformer and a 300-volt arrester to the neutral wire. Where three transformers are installed for a power service there are three 2,400-volt arresters, one connected to each phase, and one 300-volt arrester to the neutral wire. Arresters are thus installed on the same poles with transformers. The lightning arrester ground consists of ½-in. (1.25-cm.) galvanized-iron pipe, 10 ft. (3 m.) long, driven into the ground at the base of the transformer pole. Secondary circuits are usually less than one block long, and the secondary ground is similar to the lightning-arrester ground, but is installed on the next pole. Where there are four primary wires in an alley they are installed on the top arm and the secondaries on the second arm. Where there are only two primary wires the lightning secondaries may be installed on the same arm. More than 80 per cent of the poles are owned and operated jointly with the telephone company. This distribution system at present includes about 100,000 poles, 20,000 transformers, with a total capacity of 270,000 kva., 6,500 conductor-miles of overhead primary-line wire, 2,200-conductor miles of underground cable and 2,500 cable poles. The system serves about 400,000 customers.

A very comprehensive study of this extensive system enabled the author to segregate various factors in lightning troubles and study the effects of each. Many other important conclusions were arrived at and these are summarized below:

In Fig. 1 are shown electrical diagrams of all the lightning arresters used in the investigation, and the letters shown are used throughout the investigation

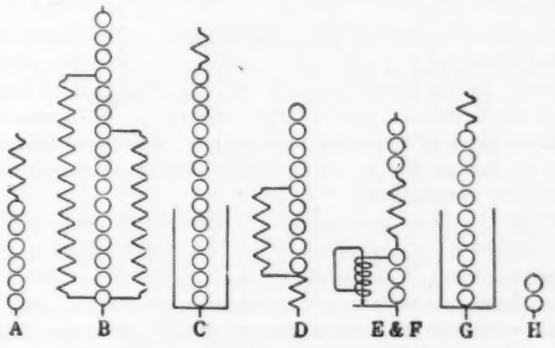


FIG. 1—LIGHTNING ARRESTERS USED IN INVESTIGATION

Type *G* was installed in 1920, while *H* represents the 300-volt arrester installed at the neutral.

to distinguish the various arresters. Fig. 2 shows graphically the number of transformers on the system over a period of years as well as the percentage of transformer primary fuses blown and transformers burned out by lightning each year. The increase in percentage of fuses blown during the year 1918 and 1919 was known to be difinitely due to other causes than lightning.

From the previous paper and subsequent studies it appears that the factors that might affect lightning-arrester performance are as follows: (1) The system of distribution and the grounding of the neutral; (2) primary terminal boards; (3) the shielding effect of trees, buildings or wires of other companies; (4) the resistance of the lightning-arrester ground connection; (5) the make of the transformer; (6) the size of the transformer; (7) the age and previous service record of the transformer; (8) variation in the distribution and intensity of the lightning; (9) the density of lightning arresters; (10) the design of the arrester.

An investigation of the records demonstrated beyond question that the shielding effect of trees or buildings immediately adjacent to the lines considerably reduced the amount of damage on these lines from lightning. This was shown by the following facts:

(a) The percentage of poles in the distribution sys-

*The first paper of this series was published in the *A. I. E. E. Transactions* in 1916, page 655, and ELECTRICAL WORLD, May 27, 1916.

tem shattered by direct strokes is extremely small, being of the order of one four-hundredth of 1 per cent. This is very much smaller than the corresponding percentage in the case of transmission-line poles belonging to the same company in the flat open country in the southeastern portion of the city.

(b) An investigation of the conditions surrounding the installation of 97 out of 529 cases covered by this

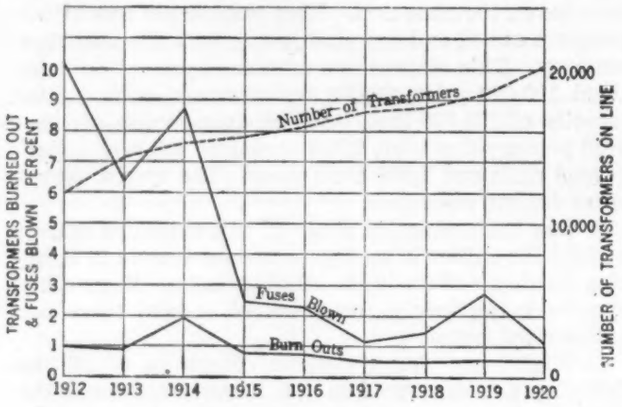


FIG. 2—TRANSFORMER TROUBLE OVER A PERIOD OF YEARS

study where transformers were burned out by lightning failed to reveal a single case in which the primary wires adjacent to the transformer were overshadowed by high trees or buildings immediately adjacent. It appeared that no type of arrester was at any serious disadvantage so far as the shielding action of trees and buildings was concerned.

With the idea that some of the transformer burn-outs might have been due to ground connections of too high resistance, the resistance was measured at ninety-seven locations where the burn-outs occurred. In the same vicinity the resistance of 2,770 grounds, both lightning-arrester and secondary, was tested in 1916; but it was found that the resistance of the lightning-arrester grounds at the points where the ninety-seven transformers were burned out by lightning averaged only slightly above the resistance of the much larger number tested three years earlier. It therefore appears that the burn-outs were not due to particularly bad ground connections.

HIGH DENSITY OF ARRESTERS REDUCES TROUBLE

For the purpose of investigating the effect of density of arresters in the distribution system on lightning disturbances, the system was divided into 192 sections, and the curve shown in Fig. 4 was plotted from the record of the number of transformers and arresters and burn-outs due to lightning in each of these districts. It will be noted that in about one-sixth of these sections the points are on zero line of burn-outs, showing that there were no burn-outs whatever in these sections during the five-year period. This curve shows that the density of lightning arresters has a very important influence on the results attained. If it be assumed, for example, that there are 1,000 transformers installed in an area of 10 square miles, each protected by an arrester on the same pole, and that later the number of transformers in this area is doubled and at the same time uniformly distributed, it should be observed that the percentage of burn-outs has decreased 1.67 per cent to 0.5 per cent, and that the actual number of burn-outs has decreased from seventeen to ten per annum. In other words, a doubling of the number of transformers and arresters in a given area will not result in more transformers being burned out by the lightning per year, as might be supposed, but will result in an actual reduction of about 40 per cent in the number of such burn-outs per year.

The data for each type of arrester were then plotted in a similar manner, but this resulted in curves which crossed each other in a confusing manner. While the curves appear to be accurate, there is no physical reason why one type of arrester should be better than another at one density and poorer at another density. The curves were therefore plotted on logarithmic paper and were found to be straight lines. The mid-point was found for each arrester and parallel straight lines were drawn through the points thus obtained, giving the curves represented in Fig. 5. It is believed that these curves represent the performance of each of the arresters with varying densities, and the most troublesome variable—that is, the variation in the distribution and intensity of the lightning—has been thus eliminated by the method of assembling the data and drawing the curves. From these curves it will be seen that the performances of four of the arresters, designated as *C*, *D*, *E* and *F*, are so close together that the differences may be considered as well within the possible errors of observation.

It will be noted that the ordinates for curve *B*, in Fig. 5, are about 40 per cent below the corresponding ordinates of the average of curves *C*, *D*, *E* and *F*. This arrester *B* is one of the oldest types on the lines and is fairly well distributed over a wide range of density.

The data showing the relation between the density of arresters and the percentage of primary fuses blown by lightning were treated in the same manner as for transformer burn-outs, giving curves which showed that these arresters were effective in the order *B*, *A*,

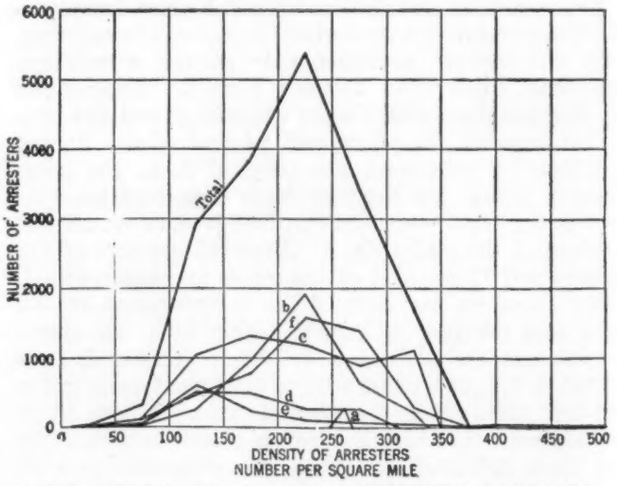


FIG. 3—DISTRIBUTION OF TYPES OF ARRESTERS AT VARIOUS ARRESTER DENSITIES

As far as possible each type was used over a wide range of arrester densities in order to separate the effects of type of arrester and arrester density on lightning interruptions.

F, *C*, *D* and *E*; that is, the number of fuses blown at any density was greatest for arrester *E* and least for arrester *B*. On account of the fuse trouble experienced in 1918 and 1919, as mentioned before, the percentage of fuses blown which in the last two years has been ascribed to lightning is known to be higher than the actual figure. The trouble was eliminated by the change of all fuses to a new type during the latter

months of 1919 and the earlier months of 1920. The marked reduction in the percentage of fuses blown by lightning in 1920 indicates that this particular form of fuse trouble has been eliminated. The principal cause of the blowing of transformer primary fuses in lightning storms is the arcing across the bushings where the primary wires enter the transformer case, and the scars from these arcs can generally be located. Some of the transformer manufacturers have increased the size of these bushings in their later designs, and the Commonwealth Edison Company's records indicate a considerable reduction in the amount of trouble from this cause with the enlarged bushings.

PROTECTING UNDERGROUND CABLES

As indicated in the description of the system, about 25 per cent of the primary feeders and mains are underground and there are about 2,500 cable poles where the underground feeders or mains are connected to the overhead wires. At all of these cable poles each of the cables is protected by an arrester installed on the cable pole in a manner similar to those installed on transformer poles. These arresters have not been included in figuring the density of arresters for the protection of transformers.

It is common knowledge in Chicago that some years ago, when the number of substations supplying the system was only one-fifth of the present number and when the average distance between transformers was considerably greater than at present, there was a large percentage of cable troubles due to lightning. The records show that, although the load has increased more than tenfold since that time and the number of cable poles has probably increased in an even greater ratio, the annual number of burn-outs of such cables due to lightning has not increased and has probably been reduced. This information, together with the curve in Fig. 4, leads to the conclusion that the arresters which have been installed on these lines for the protection of transformers must also assist in the protection of cables connected to the overhead lines. It also appears that the arresters installed on the cable poles must assist in the protection of neighboring transformers.

In cases where lightning arresters are installed at points where high-voltage cables are connected to overhead lines no company installs more than a single arrester. In Chicago there are a number of such cable poles on 12,000-volt and 20,000-volt cables, and the proportion of burn-outs of these cables due to lightning is around 10 per cent per annum, while in the 4,000-volt cables it is a small fraction of 1 per cent. In view of this experience it appears that a very considerable reduction of the percentage of such burn-outs can be obtained by the installation of additional arresters in the vicinity of the cable pole.

AN ARRESTER OF PROMISING CHARACTERISTICS

The earlier types of lightning arresters were all made with metal parts inclosed in a wooden case, but early in the period covered by these investigations a type of arrester was brought out which was self-contained; that is, the metal and other current-carrying portions of the arrester were assembled in a porcelain casing, which did not require an external wooden box for protection. The gaps in this new type, instead of being between brass points or spheres, are between circular parallel plates so that a number of successive heavy discharges will not seriously alter the total length of the gaps. Experience with these arresters pointed to the conclusion that they have many advantages over the wooden-box type besides a considerably reduced annual maintenance charge. Based on the experience obtained in these investigations, the following tentative specifications may be offered:

1. The arrester must consist of a number of gaps in series with or shunting a resistance so adjusted that the dynamic

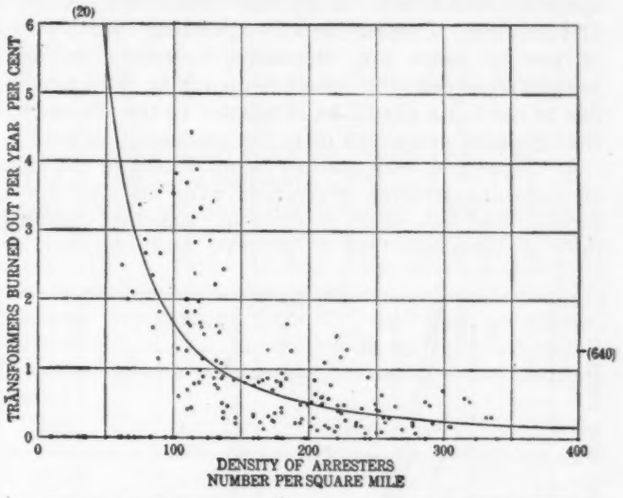


FIG. 4—VARIATION OF TRANSFORMER BURN-OUTS WITH ARRESTER DENSITY OVER FIVE-YEAR PERIOD

arc following the lightning discharge will be quickly broken without damage to the arrester.

2. The resistance rod must have the resistance uniformly distributed throughout its length.

3. The amount of resistance in the rod should not be seriously affected by repeated heavy discharges.

4. The leads for connecting the arrester to the line should leave the arrester so that they will form drip loops, and the leads should be so arranged that the arrester can be connected to a line wire on either side of the arrester.

For low maintenance cost the following are available:

5. The inclosing case should be of fireproof insulating material that is not affected by the weather. It should be constructed so as effectively to protect the metal box from weather and prevent accumulation of dust from the gaps.

6. The gaps in the arrester should be between parallel plates, disks or rings.

7. The arrester should be constructed so that in case of failure to break the dynamic arc the inclosing case will be shattered by heat, thus giving visible evidence of trouble.

8. The arrester should be without moving parts or parts which require inspection, renewal or adjustment and should preferably be made in the form which cannot be inspected or repaired without removing it from the pole.

The experience with the arresters covered by this investigation indicates that several types of arresters are now available which comply with all of these specifications. The annual maintenance cost has up to the present time averaged well below 1 per cent per annum and is practically confined to replacing of damaged arresters.

THE WHOLE STUDY SUMMARIZED

The conclusions from the investigations described in this paper, together with the more important conclusions from the previous paper, some of which have been modified and extended by these investigations, may be summarized as follows:

1. Transformer troubles during lightning storms may be reduced (a) by the removal of transformer primary terminal boards, (b) by the installation of

lightning arresters, (c) by the use of larger bushings on the primary leads of transformers.

2. Lightning arresters installed on transformer poles are considerably more effective than if installed on the line poles.

3. Even in the most severe lightning storms, which apparently cover the given territory quite completely, there will be numerous extended areas within this territory which will be entirely free from lightning disturbances. Careful records extending over a period of several years are, therefore, necessary in order to determine definitely whether immunity from troubles due to lightning should be attributed to the efficiency of the lightning protection or to the absence of lightning.

4. There is a very marked improvement in the effect of lightning-arrester protection with an increase in density, and this effect is such an important factor in their performance that no accurate comparison of the

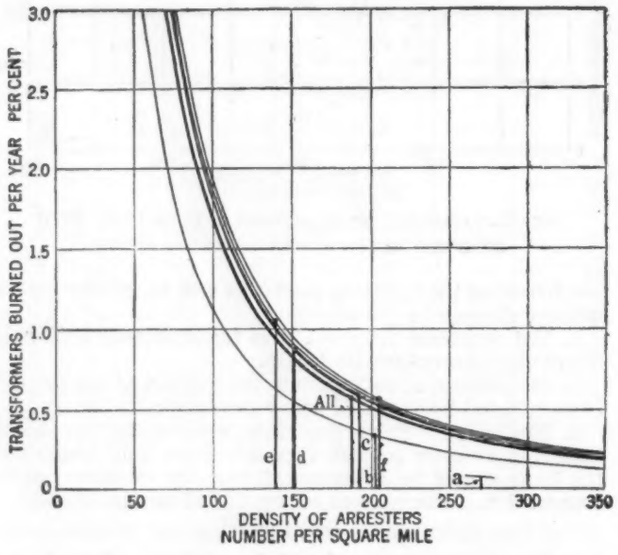


FIG. 5—PERFORMANCE OF INDIVIDUAL ARRESTERS AT DIFFERENT ARRESTER DENSITIES

The original data yielded curves which crossed each other. The curves were separated, however, by a fairly rational method.

relative merits of various types of arresters can be made without giving it proper consideration.

5. Where the density of transformers and arresters on the same pole is high the total combined effect of all of the adjacent arresters is greater than that of the arrester on the same pole with the transformer.

6. In districts where transformer density is materially below 100 per square mile, and where continuous service is important, it will probably be found desirable to install arresters on line poles in addition to an arrester on the same pole with each transformer; where the local density is about 50 per square mile or lower, the installation of such additional arresters will probably be warranted by the reduction in operating expenses.

7. The increase in the density of lightning arresters also results in a marked decrease in the percentage of burn-outs due to lightning of underground cables connected to overhead distribution circuits, and the percentage has been reduced below one-tenth of 1 per cent per annum with the density averaging about 200.

8. In the case of high-voltage cables operating at voltages up to 25,000, with one arrester at the cable pole, the installation of additional arresters in the vicinity would in all probability cause a marked reduction in the percentage of burn-outs of such cables due to lightning.

9. The density of arresters, the shielding effect of high buildings and trees, and perhaps other features, have such an important effect on the amount of trouble from lightning that no accurate comparisons of the results secured in different cities can be made without giving due consideration to all conditions under which the lightning arresters are installed.

10. For use in the protection of transformers in districts where each transformer is protected by an arrester on the same pole, and where the density of arresters ranges above 200 per square mile, the most economical arrester of the several types covered by this investigation is probably the cheapest arrester. It is entirely possible and even probable that the local conditions will have an important bearing in determining the best type of arrester to be used in any given locality, and that where the amount of shielding from buildings, trees, etc., is very slight and where the securing of adequate ground connections for the arresters is expensive, it would be preferable, even in areas of low density, to use arresters whose discharge capacity is considerably greater and whose discharge potential is considerably lower than the arresters covered by these investigations and to confine the installation of the arresters to the transformer poles.

11. It is possible by carefully distributing the various types of lightning arresters over a large area and by obtaining the results of the performance of arresters over a period of years to get data which will permit a comparison of the relative merits of the several types of lightning arresters as protective devices.

12. It is entirely possible to make lightning arresters of the self-contained type—that is, of a type not requiring an external protecting box and so constructed as not to require or permit inspection. The annual maintenance cost of such arresters is practically limited to the replacing of damaged arresters, and the total annual maintenance cost as indicated by an experience of five years with several thousand of them is well below 1 per cent of their original cost of installation.

13. A change in the form of lightning-arrester gap from a cylindrical or spherical shape to parallel flat surfaces appears to result in a form which allows repeated heavy discharges without requiring renewal or adjustment of the parts. This has been an important factor in changing the design from a type requiring annual inspection, renewal and adjustment to a type which does not permit or require such annual attention.

14. The four types of arresters which have been designated by the letters *C, D, E* and *F* (see Fig. 1), and which consist essentially of a resistance in series with a number of gaps, together with such additional features as antennas, compression chambers, expulsion chambers and solenoids to vary the length of the gap following dynamic discharge, appear to have equal value in protecting line transformers.

15. The type of arrester designated by *B*, which consists of a large number of gaps in series without any resistance, in addition to two other paths through a high and a low resistance shunting a large and a small number of gaps, appears to be a considerably better protective device than arresters designated by *C, D, E* and *F*, due to features of its design.

16. With the data in this paper it should be possible to estimate cost and results of lightning protection in Chicago with same degree of accuracy as characterizes the

estimates of cost of construction or maintenance of overhead lines, when the figures are averaged over a period of years.

17. The shielding effect of high buildings, trees and other similar features which might be considered as determining the exposure of the lines to lightning has an important bearing on the amount of damage that will be caused by lightning. In local areas of a distribution system which have for years shown a high percentage of troubles caused by lightning it will probably be found that a large percentage of troubles is due to the lack of shielding from the surroundings or to a low density of arresters, and that the trouble can be materially reduced by increasing the density of the arresters in the locality.

18. Great caution should be used in attempting to compare the results secured by lightning-arrester protection in Chicago with results secured in other localities without giving due consideration to all of the factors which might affect lightning-arrester performance.

Readers' Views and Comments

Pioneer Electrical Canal Haulage

To the Editor of the ELECTRICAL WORLD:

SIR: I am glad to see in your obituary notice of Richard Lamb reference, though brief, to his pioneer work in the effort to electrify our American canal system. That is, I fear, a well-nigh forgotten episode in electrical development of a very novel character, but let us hope it is not a closed chapter.

Mr. Lamb, as a young civil engineer with unusual inventive ability, was interested in the reclamation of the famous Dismal Swamp of his native Virginia, and his attention was arrested by the desirability of some method of "snaking" or hauling logs out of its recesses through the tortuous pools and shallow waterways. From that he proceeded by natural stages to a consideration of the canal haulage problem.

In this field Lamb began his experiments on the Raritan Canal, at Trenton, N. J., where more than twenty-five years ago he installed an ingenious system along the towpath. It consisted of pole or tree brackets carrying a steel-copper cable presenting a good bearing and wearing surface for truck wheels to ride on and affording excellent conduction for the operating current. Over this cable, by means of a truck hung vertically, a motor traveled, so working as to pull on the traction cable wound around a sheave, parallel to the bearing cable. The tow rope was attached to the Samson post of the canal barge, and the hanging frame of the motor carried also a kind of "bosun's chair" in which the motorman sat. Details and illustrations will be found in "Electrical Boats and Navigation" (Martin and Sachs, 1894) and in your own pages of that period.

Similar work was done by Lamb on the Erie Canal at Tonawanda, N. Y., and on the Lehigh Canal, and it may be remembered that kindred attempts were also made a little later on other canal sections and systems. It is a pity that for some unexplained reason interest in this desirable development died out and was not revived during these critical times in transportation, when the frightful congestion on the inadequate railroads should have given one of our earliest public utilities—the canal—a new lease of life. Why has the enlarged, expensive Erie Canal system no electrification?

My friend Lamb, although he lost no small sum of money in his gallant efforts, never regretted that he had tried hard to make good in electrical canal haulage, almost alone and unaided.

New York City. THOMAS COMMERFORD MARTIN.

Auto-Transformers for Motor Starting

To the Editor of the ELECTRICAL WORLD:

SIR: In an article entitled "Auto-Transformers for Motor Starting," which appeared in your issue of Sept. 4, page 473, a statement was made which is likely to leave a wrong impression unless it be amplified. This statement appeared on page 474, and read as follows: "Referring to Fig. 2, the same auto-transformer applies both to a 100-hp., 1,200-r.p.m., and a 250-hp., 150-r.p.m. motor."

There are at least two important practical considerations which should be introduced as qualifying this assertion:

(1) In general, in a consistent line of induction or synchronous motors, the higher-speed machines will develop a greater percentage of full-load torque when started from a specified voltage tap than will the lower-speed machines. Therefore, assuming that the device connected to the 250-hp., 150-r.p.m. motor requires the same percentage of full-load running torque at the start as does the device driven by the 100-hp., 1,200-r.p.m. motor, the result will be that a higher voltage tap will be required for starting the low-speed motor than is necessary for the high-speed motor.

(2) Perhaps of greater importance is the fact that in the usual run of industrial motor applications the lower-speed drives are almost invariably associated with service requiring a much greater starting torque relative to the normal running torque than do the high-speed drives. As typical of the service probably encountered by a 250-hp., 150-r.p.m. motor there would be grinders, crushers, compressors, line shafts, etc.—*i.e.*, devices requiring approximately full-load torque at starting. Contrasted with this, typical service of the nature of 100-hp., 1,200-r.p.m., would include fans, blowers, centrifugal pumps, motor-generator sets, etc., ordinarily requiring appreciably less than half of full-load torque to start. Therefore, again to the second degree, the probabilities are that a higher voltage tap would be required for the low-speed motor than for the high-speed motor.

Hence, if the same auto-transformer were used alternatively for the two ratings cited, there is a strong probability that when serving the low-speed motor a much higher tap voltage would be necessary, and therefore the switch contacts and windings would be subjected to much more strenuous service than would be occasioned by use with the high-speed motor. Conversely, if the auto-transformer were especially designed for the case in hand, it would be capable of much cheaper construction for the 100-hp., 1,200-r.p.m. motor than for the 250-hp., 150-r.p.m. V. S. FOSTER.

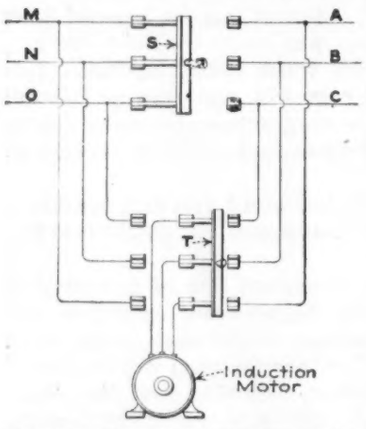
Canadian General Electric Company, Ltd.,
Peterboro, Ont.

Station and Operating Practice

A Department Devoted to Problems of Installation, Operation and Maintenance of Equipment for Economical Generation and Distribution of Electrical Energy

Safe Method of Synchronizing

TO PREVENT mistakes when connecting a three-phase generator to another generator or system with which the first generator is to be synchronized a triple-pole, double-throw switch has been used by the writer in conjunction with an induction motor for indicating direction of rotation. The switch is placed near the ends of the two lines which it is desired to connect together and jumpers are run from the lines to the three blades of the switch which is shown at *T* in the drawing. The induction motor is connected to the inside terminals of the switch. The switch is first thrown to the right and the direction of rotation of the motor is noted, and then it is thrown to the left. If the direction of rotation is not the same in both cases, two of the conductors of one line are interchanged at switch *S* to make the directions of rotation identical. Then the oil switch at the first generator is opened and switch *S* is closed. After this one phase of the generator line is synchronized with one phase of the line, after which the oil switch may be closed. The advantage of using this plan comes from the fact that the wires running from the double-throw switch to the two lines are left connected after the directions of rotation have been checked, thus preventing any chance of connecting the wrong wires of the two lines together.



SCHEME PREVENTS CROSSING WIRES AFTER CHECKING PHASE ROTATION

Trail, B. C., Canada. R. H. N. LOCKYER.

About 2,000 Lb. Is Normal Working Load for Strain Insulators

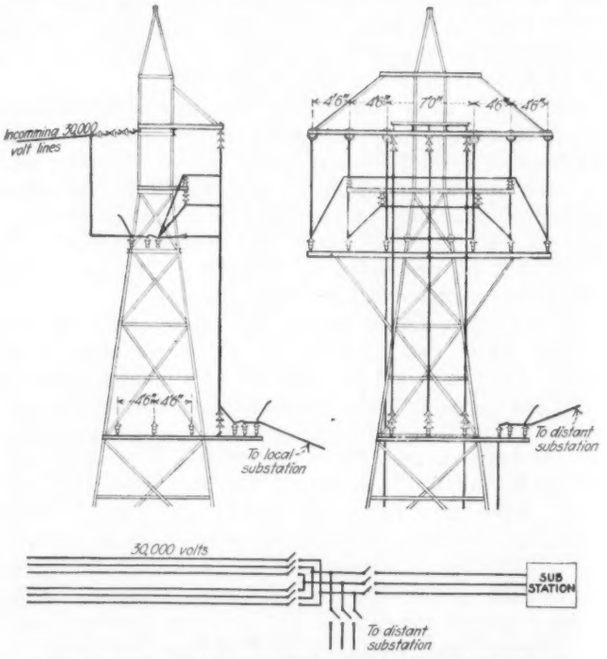
GENERAL insulator practice sanctions a normal working load of not more than 2,000 lb. (907 kg.) on strain insulators, although an occasional load, such as might result from wind and ice, reaching 3,000 lb. (1,360 kg.) is sometimes permissible. Present-day insulators might very easily stand occasional loads of 5,000 lb. (2,267 kg.), as the average ultimate strength of cemented cap and pin units is about 11,000 lb. (4,985 kg.). This is consistent with the usual practice in mechanical design wherein loads are based upon the elastic limit of the material to be used, which ordinarily is about one-half the ultimate strength. For important designs it is common practice to use a safety factor of two or even more, so that an actual load of 25 per cent of the ultimate strength is imposed. When account is taken of the fact that porcelain is far inferior to steel as a structural material, there appears no good reason why insulators should be expected to withstand the heavy loads which in times past have been placed upon them.

L. N. CRICHTON,
Supply Engineering Department.
Westinghouse Electric & Manufacturing Company,
East Pittsburgh, Pa.

Switches Mounted on Two-Circuit Steel Tower

TO SAVE the expense of erecting a switching frame, the two-circuit line tower shown here was adapted by the Cleveland Cliffs Iron Company, Michigan, for carrying four sets of disconnecting switches and the insulators on which circuits were run to the switches.

It was necessary at this tower to supply service from either or both of two incoming 30,000-volt transmission lines to a local substation and to a line going to a distant substation. The disconnecting switches for both of the incoming lines and for each of the substation circuits are mounted on steel members which were added to the structure. The rods for operating the switches extend to within a convenient distance of the ground. the base of the tower is inclosed by a wire fence which is not shown. This structure was installed at the direction of F. C. Stanford, electrical engineer for the company.



FOUR SETS OF DISCONNECTING SWITCHES MOUNTED ON TRANSMISSION TOWER

Larger Boiler Units and Combustion Chambers Increase Economy

LARGER and fewer boilers and larger combustion chambers are coming into more general use with consequent increasing efficiency. If possible, the average plant should preferably consist of not less than five or six boilers or more than about ten. Such concentration permits close supervision and the fullest possible use of recording instruments, since the cost of equipping a large boiler is little more than that for a small one. Recording instruments are regarded as essential for the close supervision necessary for high efficiencies.

Larger combustion chambers and the locating of the heating surface of the boiler as far as possible from the fuel bed, which modern developments in design have made possible, permit both high capacities and high efficiencies. In a few years Babcock & Wilcox boilers have had the distance from the bottom of the front headers to the floor line increased from 7 ft. (2.2 m.) to as high as 16 ft. or 18 ft. (5 m. or 6 m.), while Stirling boilers have had the distance of about 2.5 ft. (0.7 m.) from the center of the mud drums to the floor line increased 5 ft. to 12 ft. (1.5 m. to 3.6 m.).

Among the recently developed factors which permit the use of large combustion chambers are higher stoker efficiency, smaller relative area of outside radiating surface, smaller surface through which air can leak into the boiler, more efficient heating surface and smaller area of low-efficiency fuel bed along the furnace walls. These factors added to more careful supervision aid in maintaining the highest boiler efficiencies.

Modern practice is also calling for higher pressures. Larger boiler plants are now being built to operate at 250 lb. to 300 lb. (17.5 kg. to 21 kg.) pressure and higher, a number of plants for 350 lb. (24.5 kg.) pressure being in successful operation. Emphasis is being placed on the necessity of freedom from scale and deposit inside the boiler tubes if higher boiler ratings are to be obtained, it being necessary in many large plants to use only condensed steam for boiler feed and keep the make-up water to the smallest possible percentage, or to use evaporators to insure that no scale-forming matter enters the boilers. Treatment of raw water helps but does not remove the solids, except to some extent where settling tanks are used.

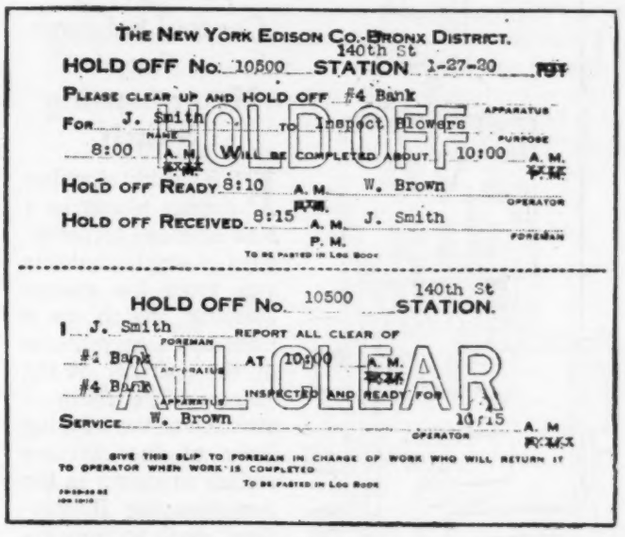
These comments were made in a paper recently presented before the station-operating committee of the Ohio Electric Light Association by R. E. Butler of the Babcock & Wilcox Company.

Hold-Off Tag Prevents Energizing Apparatus Being Adjusted

BY MEANS of the hold-off tag shown herewith operators of the New York Edison Company are warned not to put voltage on apparatus undergoing adjustment.

This tag consists of two parts, one demanding that the apparatus shall be held off the line and the other showing that the apparatus is clear and can be made alive. The first section is pasted in the station log book after permission has been granted from the operator to work on the apparatus, and when the work has been completed the second section is pasted in the book.

When work is to be done on a piece of apparatus the construction foreman fills out in detail the upper half of the tag, which is a request to keep the apparatus off the line, and names the man who will be working on the apparatus, the purpose for which the apparatus is to be held off, the approximate time when it is desired to have the apparatus killed and the approximate time of completion of the job. After the construction foreman fills out these items he hands the tag to the station operator, who takes the apparatus off the line and then records the time, signs his name and pastes this half of the tag in the log book. The lower half of the tag is kept by the construction foreman until the job is completed. It is then filled out by him in detail and handed to the station operator, who signs it and pastes it in the book, indicating that all is clear and the apparatus may be put in service.


THE NEW YORK EDISON CO.-BRONX DISTRICT.
HOLD OFF No. 10500 STATION 140th St 1-27-20
PLEASE CLEAR UP AND HOLD OFF #4 Bank APPARATUS
FOR J. Smith NAME TO Inspect Blowers PURPOSE
8:00 A. M. WILL BE COMPLETED ABOUT 10:00 A. M.
HOLD OFF
HOLD OFF READY 8:10 A. M. W. Brown OPERATOR
HOLD OFF RECEIVED 8:15 A. M. J. Smith FOREMAN
P. M.
TO BE PASTED IN LOG BOOK
HOLD OFF No. 10500 STATION 140th St
I J. Smith FOREMAN REPORT ALL CLEAR OF
#2 Bank APPARATUS AT 10:00 A. M.
#4 Bank APPARATUS INSPECTED AND READY FOR SERVICE
ALL CLEAR
W. Brown OPERATOR 10:15 A. M.
GIVE THIS SLIP TO FOREMAN IN CHARGE OF WORK WHO WILL RETURN IT TO OPERATOR WHEN WORK IS COMPLETED
TO BE PASTED IN LOG BOOK

HOLD-OFF TAG PASTED IN LOG BOOK WHILE APPARATUS IS BEING WORKED ON

Mounting Plate Saves Time in Replacing Instrument Transformers

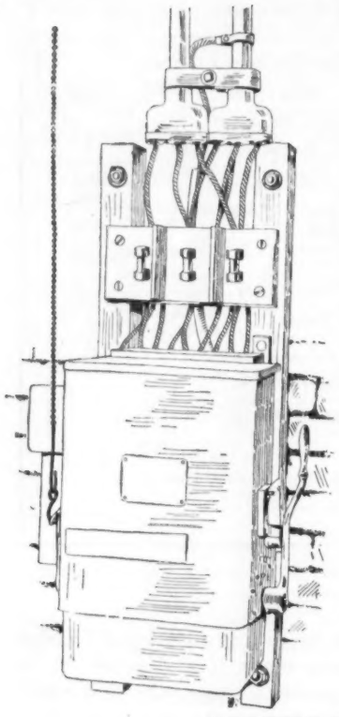
TO ENABLE instrument transformers to be quickly changed they are mounted on a plate drilled to accommodate all types in the stations of a St. Louis company. Trouble was formerly experienced in making quick changes of current and potential transformers of the air-cooled type owing to the very general practice of bolting the units directly to the walls, ceilings or steel of the building. As the design of this class of equipment is changed so frequently that a current or potential transformer can rarely be replaced with one of exactly the same type, it has nearly always been necessary to redrill the wall or steel work to accommodate the new transformer. This may cause serious service delays, and it is often a very dangerous procedure.

The adapter plate is of steel about 10 in. square by ¼ in. thick (25 cm. square by 6 mm. thick) and is supported by four corner bolts with pipe spacers which hold the plate about ¾ in. (19 mm.) away from the surface of the wall or steel work. The plate is drilled for every common size and type of current and potential transformer and has some extra holes drilled for good measure. Since this method of mounting has been adopted a transformer can be changed in a few minutes as the adapter plate eliminates all fitting and new drilling.

WALTER H. MILLAN,
Superintendent of Substations.
Union Electric Light & Power Company, St. Louis, Mo.

Industrial Applications

The Economical Utilization of Electrical Energy in Mills and Factories, Together with Practical Details of Installation, Control, Testing and Repair of Equipment Required



Emergency Control Scheme for Motor-Starting Switch

FOR quickly stopping a pony planer in a New England carpenter shop a small chain is run from the motor-starting switch to a position in easy access of the operator at the planer. The chain is attached to the tripping lever of the starting switch as shown in the accompanying illustration. Such an arrangement allows the circuit to be interrupted and instantly stops the motor in case of emergency.

Careful Adjustment Advisable with Interpole Machines

CAREFUL checking and adjusting are necessary when installing direct-current generators or motors with interpoles. Such machines are usually designed to get more output from a given amount of material than non-interpole machines, and in general they are smaller for the same rating and often run faster. The commutators are smaller, the brush current density is higher, and the machines are highly sensitive to inaccuracies in the magnetic conditions. Trouble resulting from this cause usually shows up as sparking at the brushes.

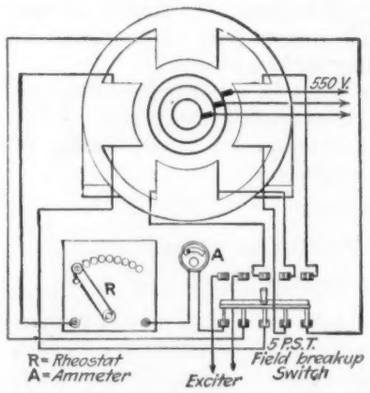
Observation of the following general precautions will help to get the best results: (1) Brushes must be accurately spaced around the commutator. The spacing is checked at the factory but should be rechecked before starting the apparatus. (2) The brush position must be on the neutral point, which is usually indicated by a mark on the brush gear. If it is not marked it should be determined and permanently marked. (3) The air gap between armature and poles should be accurately adjusted; that is, the armature must be correctly centered in the frame. (4) Strength of interpole often needs checking and adjustment in the field. This is best investigated by contact points on the commutator used with a low-reading voltmeter. (5) The compounding action of the main series field in an interpole machine is the same as in an ordinary machine, and the influence of the load on the terminal voltage (if a generator) or speed (if a motor) can be adjusted by the use of a shunt across the main series-field terminals. (6) For parallel operation with other machines, either interpole or non-interpole, the equalizer connection is made at the end of the main series winding and not directly to the armature terminal. All other essentials for parallel operation are the same as for ordinary machines.

As the commutator in this type of machine is given harder duty for its size, small irregularities or roughness which might cause no trouble and gradually cure themselves in an ordinary machine are liable to grow worse and cause sparking; hence the commutators must be kept quite true and smooth. Usually the best operation will be obtained with soft brushes and undercut commutator mica, the undercut or slotting being about $\frac{1}{32}$ in. (0.8 mm.) deep.

JAMES DIXON.
Reliance Electric & Engineering Company,
Cleveland, Ohio.

Changing a Generator to a Synchronous Motor

CONVERTING a 75-kw., 550-volt rotating-armature generator into a synchronous motor recently brought some unexpected difficulties to the writer's attention. It was first thought there would be trouble in making the motor self-starting. However, on account of the field pole pieces being solid and the machine not being equipped with damper bars, when the current was applied to the slip rings eddy currents were induced in the pole pieces which produced sufficient torque to bring the machine up to speed. During the process of starting the field was left open-circuited, which very soon resulted in the insulation on the field spools breaking down to ground, especially at the ends of the winding where the induced voltage was at a maximum. This induced voltage is set up by transformer action between the armature and field. The very instant current is applied to the armature this induced voltage is at its peak, and it gradually falls virtually to zero as the rotor approaches synchronous speed. In the above case this voltage was 800, which not only was dangerous to the winding but set up an extra hazard to the operators as the field switch was



FIELD BREAK-UP SWITCH PREVENTS HIGH VOLTAGE ON STARTING SYNCHRONOUS MOTOR

mounted on the face of the control panel. To eliminate this trouble a field break-up switch, as shown in the sketch, was mounted at the rear of the panel and operated from the front with a rod. This reduced the voltage to approximately 200 and permitted the machine to retain its proper starting torque.

Before installing this switch the plan of connecting a shunt on the field circuit was tried unsuccessfully. It is now a general practice with synchronous motors to shunt the field during starting with a shunt large enough to carry the no-load excitation current of the machine and having at least fifteen times the resistance of the field winding. Such a shunt and shunts of other resistance values were tried, but these prevented this machine from developing the proper torque and coming up to speed.

R. H. N. LOCKYER.

Trail, B. C.

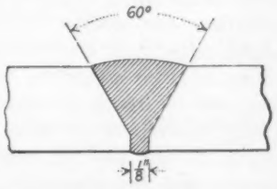
Speeds Attained in Electrical Hand Welding

SPEEDS attained in electrically butt-welding ½-in. steel plates, given in the accompanying table, are averages of a large number of tests. The pounds per hour deposited on work already lined up inside of buildings was 1.8 lb. (0.8 kg.) per hour, though this speed varied with the angle of the notch used. It will be noticed from the table that the greatest strength was obtained with a 60-deg. notch. In bending tests the 60-deg. weld bent through an angle of 15-deg. before cracks started, while a 30-deg. weld bent through only 9 deg. Although the feet welded per hour with a 30-deg. notch was more than one and a half times that with 60-deg. notch, the ultimate strength was considerably less. The speed in welding horizontal joints is about 80 to 90 per cent of that for vertical welding, and the speed of overhead welding is 60 per cent of the vertical speed. On an average about 70 per cent of an electrode was deposited in the weld, 18 per cent was wasted by scattering and 12 per cent was burned.

TIME, METAL, CURRENT AND ENERGY USED WITH WELDS OF DIFFERENT BEVELS ON ½-IN. PLATES

	Opening of Bevel in Degrees			
	30	60	90	120
Ultimate strength, lb. per sq.in.	44,000	51,000	45,300	48,800
Angle of bend at which cracks start, deg.	9	15	13	14
Feet welded per hour	3.22	1.90	1.50	1.07
Electrode required per foot of weld, lb.	0.85	1.25	1.54	2.29
Electrode deposited per hour, lb.	1.82	1.61	1.82	1.81
Per cent of electrode wasted	34	32	21	26
Amperes	160	145	118	125
Circuit kilowatts	9.91	9.00	7.60	8.25
Kilowatt-hours per foot of weld	3.1	4.7	5.1	7.7

A type of notch which has been found to increase the speed of welding is shown in the accompanying figure. This notch has parallel sides extending a short distance from the bottom of the notch in place of the diverging sides in the ordinary type of notch. The speed of welding with such a notch was 2.8 ft. (0.84 m.) per hour against 2.3 (0.69 m.) ft. with the ordinary "V" notch, and only 0.9 lb. (0.4 kg.) of electrode was consumed per foot of weld against 1.1 lb. (0.49 kg.) in the common type of notch.



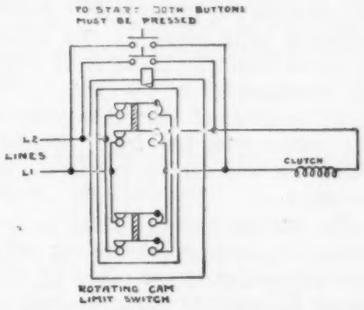
NOTCH FOR SPEEDY WELDING

Speed of welding with notch of this shape is 20 per cent greater than speed with the ordinary "V" notch, and electrode consumption is 20 per cent less.

This information was embodied in a paper prepared by William Spraragen, secretary of the engineering division of the National Research Council, for presentation before the American Welding Society at New York.

Magnetic Clutch and Button Control Make Toggle Presses Safe

TO ELIMINATE any possibility of operators being caught in toggle presses when reaching in to remove the finished product or to insert material, a Cleveland rubber company is using magnetic clutches operated by limit switches of the rotating cam type. The toggle presses are continuously running machines for making small molded rubber articles and operate at a certain number of cycles per hour. A definite time is allowed during each cycle for removing the finished article from the mold and inserting the new material before the platen of the press starts upward. Occasionally an operator does not move his hand away from the platen soon enough, the result being a severe injury when the platen moves forward toward the upper head of the press.



SAFETY AUTOMATIC CONTROL CONNECTIONS USED ON TOGGLE PRESS

To eliminate this hazard a magnetic clutch is installed on the driving shaft, which also carries a flywheel. One member of the clutch drives the press through a pinion and is bushed on the main driving shaft, to which is keyed the other clutch member. Upon disengaging the clutch while the press is operating the platen comes to rest almost instantly, making it unnecessary to stop the motor and flywheel. Connected in each circuit to the clutch are two push-button switches and a limit switch of the rotating cam type. The limit switch is directly connected to the driven member of the press, so that it makes a complete cycle for each cycle of the press. The push-buttons are mounted on the front of the press convenient to the operator.

To energize the clutch and start the press the operator must press the two push-buttons with his hands. This insures that his hands will be out of the danger zone. After the clutch has been energized the circuit is maintained by the limit switch, so that it is necessary to hold the buttons closed for only an instant when starting. The platen completes its upward stroke, and as soon as it starts downward the operator removes the molded product and inserts another batch of material for molding. If he has completed his work before the platen again begins to travel on its upward stroke, he simply holds both push-buttons depressed for an instant until the limit switch has time again to maintain the circuit for the clutch. Should he for some reason fail to complete this work before the platen begins its upward stroke, the limit switch will automatically release the clutch and stop the press.

The clutches, push-button switches and limit switches used on this installation were made by the Cutler-Hammer Manufacturing Company of Milwaukee, Wis.

Cleveland, Ohio. J. K. GOVAN.

Central Station Service

A Department Devoted to Commercial Policy and Management Topics, Including Methods of Increasing the Use of Electric Light, Power and Heat

Officers of Baltimore Company Maintain Open-Door Policy

THAT the officers of the Consolidated Gas, Electric Light & Power Company of Baltimore maintain at all times an open door for the visits of employees was emphasized by Vice-President Charles M. Cohn in an address to about 1,500 employees at the recent company rally given by the Baltimore Section of the National Electric Light Association. This attitude of the management of the company, he pointed out, is due to the realization that it is practically helpless without the organization backing it up, and it intends to deserve the active and cordial support of every employee of the company.

"It intends in the future as in the past," said Mr. Cohn, "to have an open-door policy. By this I mean that no matter if the doors of our offices happen to be closed in reality, you are always welcome to come in if you want to see and talk with any of us, and you may be assured that you will receive considerate treatment and that whatever you have to say will be listened to patiently and sympathetically. What you want done will be considered carefully, and while you may not always get what you want, you will always get a reason for our action and, if possible, you will get what you want.

"I wish to emphasize the policy of the management because I am fearful that many of our employees either through timidity or fear, or perhaps thinking we do not mean what we say, refrain from coming to see us even when they have the desire. Some few during the past year have come. We have been glad to see them, and in most instances they presented requests which were granted."

Cost of Coal Is 76 per Cent of Generating Expense

COST of coal was about 76 per cent of total operating expenses of a 63,000-kva. steam station in New England for the year ended June 30, 1920. A study of the cost sheets of this station show that the total operating expense was $849,891, of which $644,285 was expended for fuel, giving a fuel cost of 0.865 cent per kilowatt-hour produced at the plant, or virtually the same as the total unit production of the station a few years ago. The fuel expense amounted to more than seven times the station labor outlay, which was $87,495, or 0.118 cent per kilowatt-hour.

The total production cost for last year was 1.14 cents per kilowatt-hour. During the year the plant burned 100,097 tons of coal at an average cost of $7.17 per ton. The output at the bus in the year was 74,278,000 kw.-hr. The maximum load was 26,000 kw. and the yearly load factor 32.6 per cent. Two 20,000-kva., two 7,850-kva. and three 2,500-kva. turbo-generator sets comprised the main electrical units, and the boiler plant was a modern installation with water-tube units and mechanical stoking.

ITEMIZED COST OF PRODUCTION IN 63,000-KVA. PLANT

Coal	$644,285
Rentals	1,800
Oils, waste, packing	4,052
Water	1,844
Station wages	87,495
Station expense, tools, etc.	12,504
Station building repairs	16,254
Steam equipment repairs	69,134
Electrical equipment repairs	12,523
Total	$849,891

During the year some heavy steam-plant repairs were executed at a cost of $69,134. The remaining items in production, as the accompanying table shows, were of minor significance as compared with the amount expended for fuel.

Relation of the Investor to Public Utility Good Will

NEXT to financing and rates the most important problem occupying the attention of the electric light and power companies' executives is that of public relations and good will. Wherever these executives gather for conferences or conventions that part of the program devoted to this subject is met with extreme interest and attention. The National Electric Light Association, sensing this situation, has this year organized for the first time a national section devoted to public relations, and among its activities is that of bringing home to the people the truth that through their individual relationship either as consumers or investors the utilities are in a measure inseparably linked with their own prosperity and income. The last phase of this program is a series of four bulletins designed to instill in the minds of investors in public utility securities a true realization of the intrinsic worth of the electric service companies to the community and the consequent building up of their individual incomes. The pamphlets are to be distributed not only by the public utilities but also by investment bankers dealing in public utility securities.

The general type of these pamphlets can best be indicated by reprinting in full the text matter of one of them as follows:

MR. AND MRS. SECURITIES HOLDERS:

As the owners of electric utilities securities you doubtless have been watching the bond and stock market, and perhaps you have been somewhat disturbed because of conditions reflected in the prices of the securities you hold.

Far from being perturbed, you should find encouragement in the present situation. No less an authority than the National City Bank of New York City recently stated that:

"The installation of electric power in factory operations has resulted in an enormous demand on the power companies to supply current. The large central stations have demonstrated their ability to produce and distribute power at such an economical unit cost that their position is permanently assured."

This can have but one meaning to holders of sound electrical securities: Your principal and interest are safe; your investment is secure.

In addition, your holdings have a certain speculative value, in the expectation of appreciation.

Have you studied conditions so that you understand how essential the electric light and power industry is to your community and your state and the nation as a whole; how basically sound the industry is; how certain is the growth of this industry, with resultant increased business and income and consequently increased value of its securities?

You should. Your local investment banker will aid you.

As the owner of electric light and power utilities securities you should realize just what this industry means to the prosperity of your community and how its growth must keep pace with the growth of the community.

Have you ever considered the extent to which the business of your community is dependent upon the electric light and power utility serving it?

Have you ever given a thought to how many of the necessities, comforts and luxuries enjoyed by yourself and your neighbors are made possible by the use of electricity?

Are you in a train, an automobile, a street-car; in your home, your office, your club? Electricity plays an important part in all these.

This being so, the future of an industry so closely allied to *all* modern activities must be apparent.

At present the demand for electric light and power is almost one-third greater than its available supply. The demand is growing by leaps and bounds while the available supply is being increased but slowly owing to the lack of money with which to meet the immense cost of constructing additions to existing plants and systems.

If the law of supply and demand holds good in this as in all other things, all indications are for a brilliant future for electric light and power utilities.

The holder of such securities who purchases additional electric utilities securities at the present market price is taking advantage of existing financial conditions to secure a larger rate of return upon his investment than holders of these securities ever before have enjoyed. He is also helping to build up the value of the securities he already holds by making it possible for the utility to increase its plant capacity or extend its distribution system to meet the demands for service and thus increase its business and consequently its revenues.

The individual with surplus money at present, whether it be a small sum or a large amount, has an enviable opportunity to lay the foundation for an immediate and continuing income by the purchase of stable, attractive securities at prices to yield from 7 per cent to 8 per cent.

Money is playing a Dr. Jekyll and Mr. Hyde rôle at present. Spent for necessities of life or luxuries, it has little more than one-half its 1914 purchasing power; invested in good electric light and power industry securities, it purchases nearly one-third more face value of stocks and bonds, with an assured income from one to one and one-half times greater than the pre-war return from the same investment.

Conditions are unusual, and the wide gap between the purchasing power of money when applied to commodities and its purchasing power when applied to securities and interest upon itself must gradually lessen until they again are approximately level. The trend in that direction is already apparent, and when it is realized new issues of securities will be at higher prices and lower interest rates.

When that occurs, the holder of sound electric light and power securities purchased under present conditions still will be enjoying an income based upon present conditions.

Ask your local investment banker to explain how you can benefit by the present low-priced and high-rate-of-return electric light and power company securities.

Being regulated by state and municipal authorities—who are *your* representatives—your investment is safeguarded by you yourself and your personal representatives on the governing bodies.

You can build no better for the future than by putting your money in this growing business you control.

Samuel Insull Offers Prizes for Constructive Suggestions

THERE is a popular and overworked pastime which consists in telling the other fellow how to run his job, but Samuel Insull, president of the Commonwealth Edison Company, Chicago, seems to think it is much more profitable for all concerned when employees try to improve the efficiency of their own work and of their own department.

It is Mr. Insull's practice each year to give a number of prizes for the best papers on a given subject, and in order to encourage the employees to make their own work and department more efficient he has made this the subject of the competition next year. In concluding the announcement Mr. Insull said: "If every employee will think of the problems encountered in his work, analyze the conditions and make concrete and constructive suggestions, it will be a great help to the management of the company in the conduct of its affairs and will give the employees a chance to present their plans to the management."

Accidents Due to Electrical Causes Show Marked Decrease

A STUDY of accidents to employees of the Consumers' Power Company for the first eight months of this year shows a total of 380. The company operates thirty-two steam and hydro-electric plants and seven gas stations, serving through an extensive transmission system eighty-nine municipalities in Michigan. This figure takes in all departments of the company—construction, distribution and sales, production and transmission and the gas department—and includes such accidents as slight cuts and burns as well as those of a more serious nature.

Of the 380 cases, forty-five were serious enough for compensation and involved lost time to employees. With one exception, the serious accidents—those involving compensation—in the production and transmission department occurred in the steam plants. None of these accidents occurred in the substations or hydro-electric plants.

There were no accidents in any of the steam plants, hydro-electric plants or substations due to electric shock that were serious enough for compensation. Only one serious case of electric shock occurred, and in this instance the victim was promptly restored to consciousness by the application of the prone-pressure method of resuscitation.

Virtually all of the serious accidents in the construction and the distribution and sales departments were due to electric shock. The serious injuries in the stations and substations were due to cuts, bruises, burns and falls.

An analysis of the accidents to employees of the production and transmission department made some years ago showed that 40 per cent of the total were caused by electricity. A later analysis shows that 4 per cent of the accidents were due to electric flashes and burns. Owing to effective application of the prone-pressure method of resuscitation the last analysis, covering a period from Jan. 1 to Sept. 1, 1920, shows that electrical accidents which have proved serious in the generating stations and substations have been reduced to a minimum.

Digest of Electrical Literature

Including Brief Abstracts of and References to Important Articles Appearing in the Scientific and Engineering Press of the World

Lamps and Lighting

A New Form of Portable Light Meter.—DAVIS TUCK.—This paper describes the construction of a small portable light meter capable of making measurements of the same order of accuracy as the larger portable illuminometers. The assertion is made that it is possible to measure candlepower, millilamberts and foot-candles to a reasonable degree of accuracy with this instrument, which is said to be small enough to be put in a brief case or traveling bag.—Paper presented before Illuminating Engineering Society's Convention, Oct. 18, 1920.

Measurement of Diffuse Reflection Factors and a New Absolute Reflectometer.—A. H. TAYLOR.—The complete theory of the reflectometer was described by the author briefly in the ELECTRICAL WORLD for Sept. 4, 1920, on page 467.—*Scientific Paper No. 391, U. S. Bureau of Standards,* July 28, 1920.

Generation, Transmission and Distribution

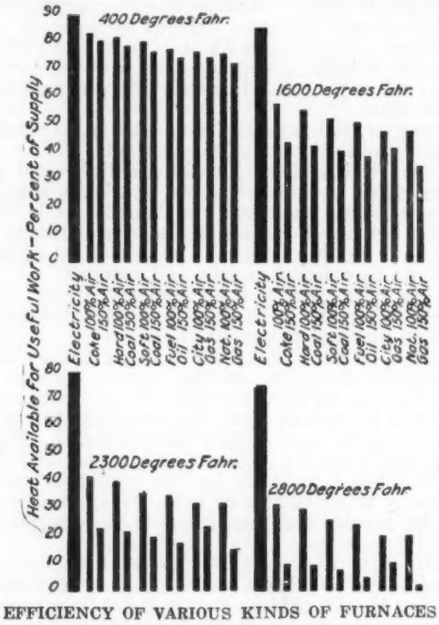
Characteristics of Lead-Covered Single-Conductor Cables.—CAPDEVILLE.—Single-phase cables usually are not steel-taped, but only lead-covered, since the presence of closed ferromagnetic circuits around the cable would give rise to hysteresis and eddy-current losses. Even the lead sheathing, however, will take up some magnetic flux, and secondary currents will be induced. The author shows that these secondary sheath currents may react quite appreciably upon the electrical characteristics of the cables, and he derives expressions for the apparent changes in inductance and resistance due to induced currents. The sheath currents, according to the author, often amount to as much as 100 amp. or 150 amp., and the voltage drop along the cable due to these currents may be 50 volts per kilometer (30 volts per mile). Actual measurements of the apparent inductance and resistance made by the author on lead-covered cables gave results which checked within 1 or 2 per cent with the theoretical values.—*Revue Générale de l'Electricité,* Aug. 7, 1920.

Graphical Determination of Voltage Distribution in Networks.—THOMALEN.—The author refers to a recent paper by Schwaiger on the same problem and presents a method for graphical determination (to the complete exclusion of intermediate numerical work) of the currents flowing from the points of supply in a network which is supposed to be loaded only at the knot points. The method represents a modification and completion of the Schwaiger method and, like that one, is based upon the principles originally suggested by Frick in his purely numerical network scheme for finding current and drops in closed networks.—*Elektrotechnische Zeitschrift,* Sept. 16, 1920.

The Dalmarnock Power Station.—This is a new power plant erected on the River Clyde not far from Glasgow. The ultimate capacity of this plant is placed at 150,000 hp. and the first 25,000-hp. unit has already been put on the load. While the generator voltage is 6,500, this is stepped up to 20,000 volts and transmitted to the substations over three-core split conductors and six-core type cables, using the Merz-Hunter system of protection.—London *Electrician,* Sept. 20, 1920.

Installations, Systems and Appliances

Relative Thermal Economy of Electric and Fuel-Fired Furnaces.—E. F. COLLINS.—The pronounced advantages of the electric furnace in providing easy and positive temperature control and uniform heat distribution are held to account for the large number of these furnaces that have been placed in service during the last few years. It is said that nearly all the brass-melting furnaces now being installed are electric furnaces. The illustration shows in a striking manner the relative efficiency of the various fuels at four chosen temperatures. While in many cases the electric furnace was selected on the basis of performance rather than on cost of operation, the rising cost of fuel and even the cost of operation may be decidedly in its favor, as is shown by data on specific installations.—*General Electric Review,* September, 1920.



EFFICIENCY OF VARIOUS KINDS OF FURNACES

Electrophysics and Magnetism

The Condenser Machine, a New Electrostatic Generator.—WOMMELSDORF.—The Holtz-Wimshurt electrostatic machine is not adapted for technical needs as a generator of high-tension direct current because of its compact design, which makes it difficult to keep certain insulating surfaces clean and dry. The author in 1914 devised a modified electrostatic generator which subsequently was developed into a useful laboratory tool. The new design is called the "condenser machine" and is

said to be very easy to keep scrupulously clean owing to its open design. At the same time it is asserted that it gives considerably greater output than a Holtz machine of similar dimensions and the same number of disks. After a brief description of the new design, the author presents a table showing the output of different sizes of condenser machines. While a Holtz machine with two disks of 26 cm. (10 in.) diameter is said to give a maximum spark length of 10 cm. (3.95 in.), a machine of the new type with the same disk diameter but only one disk gives up to 19 cm. (7.5 in.) sparks. The maximum current is for the former machine 0.015 milliamp., but for the new type amounts to 0.4 milliamp. The largest Wommelsdorf machine mentioned in the table has seven disks of 55 cm. (21.7 in.) diameter, and gives up to 35 cm. (13.8 in.) sparks, and currents up to 4 milliamp., while it takes a 1-hp. motor to run it. The spark lengths above refer to 50-cm. (19.8-in.) spheres and thus correspond to pressures from 100,000 volts to 250,000 volts.—*Elektrotechnische Zeitschrift*, Sept. 16, 1920.

Electrochemistry and Batteries

Two Common Failures of the Clark Standard Cell.—E. C. MCKELVY and M. P. SHOEMAKER.—The causes and effects of the cracking of Clark cells at the amalgam terminal and the formation of gas in the amalgam limb are discussed. It is shown that the cracking of the cell can best be prevented by the very simple expedient of using a cell blank in which platinum wire previously subjected to the action of zinc amalgam is employed as the negative terminal; also that the effects of gas formation can be minimized through the employment of the smallest excess crystals required to insure saturation at the highest temperature at which the cell is to be used.—*Scientific Paper No. 390, U. S. Bureau of Standards*, July 21, 1920.

Units, Measurements and Instruments

Errors in Current Transformer Ratio and Phase Angle Due to Remanent Magnetism.—ENGELHART.—By means of a compensation method due to Schering and Alberti (see *Zeitschrift für Instrumentenkunde*, 1917, Vol. 37, page 98) the ratio and phase errors were determined for eight current transformers of different types, the transformers having previously had different magnetic treatments. After a magnetization of the core with 4 amp. direct current in the secondary winding (the normal meter current was in all cases 5 amp.) ratio errors of 0.1 to 0.3 per cent could be observed at full load, while the phase errors came out from 0 min. to 14 min. At one-tenth of full rated current the largest observed errors were 1.8 per cent in ratio and 1 deg. 25 min. of phase angle. The effect of the usual demagnetization process with alternating current was investigated and it was found that the polarization of the transformer core was completely destroyed by such a process, if the demagnetizing current was adjusted to 0.3 amp. and slowly diminished to 0.003 amp. The article contains a great amount of numerical material, covering the results of numerous different tests of similar type.—*Elektrotechnische Zeitschrift*, Aug. 19, 1920.

Measurement of Maximum Demand and Determination of Load Factor.—PERRY A. BORDEN.—Some conclusions resulting from the author's study of equitable methods of determining power charges may be stated as follows: (1) In the determination of demand it is not feasible to obtain a quantity which will fairly represent all the factors to be taken into consideration. It is probable that the most logical quantity will be found in the volt-amperes of the load. (2) Values of "sustained peak" as determined from the charts of graphic meters are frequently misleading and of little significance. (3) Values of averaged or integrated peaks are difficult to measure on graphic meter charts and are subject to a large personal error. (4) Readings of the Merz or "block interval" type of meters, though in themselves very erratic, will in the long run average more closely to the arithmetical average than the indications obtained by any other method. (5) Individual readings of the logarithmic meters are more consistent and usually closer to the true value of the arithmetical averages than are the individual readings of the Merz meters. (6) Since heating follows a logarithmic rather than an arithmetical law, it would seem where heating is being taken into consideration that the logarithmic average is quite as justifiable as the arithmetical for a basis-of-demand measurement.—*Journal A. I. E. E.*, October, 1920.

Telegraphy, Telephony and Signals

High-Frequency Multiplex Telephony and Telegraphy in Germany.—K. W. WAGNER.—Some of the earlier German experiments with carrier-wave multiplex telephony and telegraphy were dealt with in the Digest of the Feb. 7 and July 10, 1920, issues. The development work has proceeded so far that commercial multiplex service is now maintained over a number of trunk lines in Germany, and the matter has been made the subject for an extensive report by the author, who has been in charge of the preparatory research work. Three simultaneous telephone connections are now regularly given over a 300-km. (187-mile) line between Berlin and Hanover and over a 600-km. (374-mile) circuit between Berlin and Frankfort. On an ordinary telephone line between Berlin and Magdeburg two carrier-wave telegraphic connections, utilized for two sets of Hughes-apparatus, are duplexed. One Berlin-Frankfort line serves simultaneously six Siemens instruments for rapid printing telegraphy, and at the same time the line is used for the ordinary telephone service. The six Siemens printers work at an average speed of 4,000 words a minute, and during an eight-hour day, assuming 50 per cent utilization, there may be handled over this one line no fewer than 16,000 telegrams of ten words each with an average of six letters per word. The author describes old and new apparatus used for carrier-wave multiplex service and presents thirteen photographs of equipment for experimental and commercial use. The outfits are based on the use of vacuum tube oscillators and amplifiers, mostly using triodes or tubes with three electrodes, but in the receiving apparatus for printing telegraphy some large tetrodes are employed. These have two controlling grids.—*Elektrotechnische Zeitschrift*, Sept. 9, 1920.

Miscellaneous

On the Use of Bi-symbolic Equations in Electrical Engineering.—AUGUST HUND.—The author has developed a peculiar kind of analysis, based upon what he calls bi-symbolic equations. In the present article he uses this analysis for studying the effect of negative resistance in electric circuits, and extends the treatment to certain oscillation problems involving arcs and apparatus of the dynatron type.—*Elektrotechnik und Maschinenbau*, Aug. 22, 1920.

News in Brief

Summary of Market Conditions and of Recent and Approaching Happenings of Importance to the Industry

DESPITE the urgent representations of the National Committee on Gas and Electric Service that the Interstate Commerce Commission has failed to meet the requirements of the coal situation as it affects public utilities and that the assigned-car privilege should be restored, the commission maintains its plan of emergency service, and conditions as regards adequate storage for winter are growing worse.

A THREAT to recommend to the United States Senate that the federal goverment take over the control of the coal mines has been made by Senators Calder and Edge of the Senate reconstruction committee, who assert that this action will be taken by them unless there is a material reduction in price by Dec. 6.

SOFT-COAL prices will continue to drop, the National Coal Association says, as the result of an output of 12,000,000 tons a week.

PERMISSION to develop an additional 15,000 hp. of hydro-electric energy has been refused to the Toronto & Niagara Power Company by the Ontario government unless the company will accept a rate to be fixed by a government commission. Agitation for an embargo on the export of electricity from the province continues.

THE GOVERNMENT of Canada has reduced the amount of electrical energy that may be exported by the Niagara companies under their licenses from 110,000 kw. to 80,000 kw. This order does not lessen the amount at present being transmitted to the United States.

AN "EQUALIZING reserve," to be increased in good years and drawn upon in poor ones, was advocated by the Southern California Edison Company in rate hearings before the California Railroad Commission. The company desires also to establish an account providing "rewards for efficiency" of employees.

ISSUANCE of a permit to the Pit River Power Company of California has been authorized by the Federal Power Commission on legal advice that no rights of the United States would thus be impaired. Ten projects had been advertised up to Nov. 8 inclusive.

A SURVEY of the basin of the Tennessee River is being made by the Corps of Engineers, U. S. A. On account of the heavy fall of the river and its mountain tributaries the survey is of much interest in connection with water-power development.

GREATER sales effort is found necessary in order to move the electrical materials which are coming in from manufacturers, and jobbers' shelves are being rapidly filled. Buying continues at a curtailed rate. The South is the only section that shows any activity in the building market, and consequently the jobbers' recently acquired stocks of wiring material are not moving well. Considerable activity in alterations to buildings is, however, reported.

ELECTRICAL exports for the month of September reached a value of $7,307,068. For the first nine months of 1920 they were $68,329,414.

A DECISION dismissing the suit of the General Electric Company against the Ohio Brass Company, in which contributory infringement of patents concerning suspension insulators for use in the transmission of power was charged, has been handed down in the United States District Court of New Jersey.

THE REQUEST made by the Detroit Edison Company to its lighting customers to use as litle electricity as possible during factory hours has been withdrawn with the starting up of the new 45,000-kva. generator at its Delray plant.

ON NEXT Tuesday the Boston Edison rate case will be reopened by the Massachusetts Department of Public Utilities.

TWENTY-ONE engineering societies thus far have taken action qualifying them as charter members of the Federated American Engineering Societies.

THE INDICTMENTS charging the Brooklyn Edison Company with violation of the Lever act by conspiring to pay excessive prices for coal and by hoarding coal have been dismissed by the United States District Court.

A MOVE to abolish the Public Utilities Commission of Illinois has already been made by Chicago officials, who base their action largely on the result of the recent state election.

LEWIS NIXON has resigned as Public Service Commissioner for the First District of New York State, and the Governor has appointed Deputy Commissioner Alfred M. Barrett to succeed him.

A PROTEST by the Webster & Southbridge Gas & Electric Company against the sale of energy in bulk in its territory by the New England Power Company has been disregarded by the Massachusetts Department of Public Utilities.

AUTHORITY to enter the wholesale energy market in the territory of the Adams Gas Light Company has been granted to the New England Power Company.

FIGURES of electrical generation by public utilities for the month of August issued by the Geological Survey indicate a total of 3,705,184,000 kw.-hr., or 96,000,000 kw.-hr. more than for July. Hydro-electric generation was 1,500,000 kw.-hr. behind July.

INTEREST in power development and irrigation greatly exceeds any concern as to water transportation on the Snake and Columbia Rivers, on the Pacific Coast, according to the Board of Engineers for Rivers and Harbors.

REPRESENTATIVES of examining boards from six states met in Chicago this week and formed the National Council of State Boards of Engineering Examiners for the promotion of uniformity of practice and reciprocal relations.

LIABILITY insurance on rural transmission lines is being taken up with the insurance companies by a committee of the Iowa Section, N. E. L. A.

MEMORIAL exercises for the late Dr. Samuel Sheldon of the Brooklyn (N. Y.) Polytechnic Institute will be held in New York Nov. 17.

PLANS for the good-will advertising campaign of the N. E. L. A. manufacturers' advertising committee are progressing well, many manufacturers having pledged at least one-twelfth of their advertising space during the coming year.

DR. SAMUEL J. MELTZER, an active figure in bringing about the adoption of the prone-pressure method of resuscitation from electric shock, died in New York last Sunday.

News of the Industry

Chronicle of Important Events and General Activities in the Technical, Commercial and Manufacturing Fields With Announcements and Reports of Association Meetings and Conventions

Large Charter Membership for Engineering Federation

FINAL touches are being put upon the plans for the first meeting of the American Engineering Council of the Federated American Engineering Societies, to be held Thursday, Friday and Saturday of next week in Washington at the New Willard Hotel. Thus far twenty-one societies have signified their intention of becoming charter members of the federation and a number of others have signified that they will join at some time prior to the meeting. Those societies which have already joined represent more than 42,000 engineers.

It is not known at this writing just how many delegates will attend the meeting, but it has been learned that advance reservations for accommodations in Washington have been large. The twenty-one societies are:

Alabama Technical Association.
American Institute of Chemical Engineers.
American Institute of Electrical Engineers.
American Institute of Mining and Metallurgical Engineers.
American Society of Agricultural Engineers.
American Society of Mechanical Engineers.
Associated Engineering Societies of St. Louis.
Cleveland Engineering Society.
Detroit Engineering Society.
Engineers' Club of Baltimore.
Engineers' Club of Buffalo.
Engineering Association of Nashville.
Grand Rapids Engineering Society.
Kansas Engineering Society.
Louisiana Engineering Society.
Mohawk Valley Engineers' Club.
Society of Industrial Engineers.
Technical Club of Dallas.
Washington Society of Engineers.
York Engineering Society.
Engineers' Club of St. Louis.

Brooklyn Edison Company Freed from Coal-Hoarding Charge

INDICTMENTS against the Brooklyn Edison Company and the Adelphia Coal Company which charged these companies with conspiracy to pay excessive prices for coal and with hoarding coal in violation of the Lever law were dismissed on Nov. 10 by Federal Judge Mayer in the United States District Court.

Decision was reserved in the case against the B. J. Lynch Coal Company, which has to do with the alleged misuse of priority permits gained through the instance of the Brooklyn Edison Company. Decision was also reserved in the case against Walter F. Wells, vice-president of the Brooklyn Edison Company. Harry P. Wood, formerly in charge of all the company's coal transactions, pleaded guilty recently. Judge Mayer said in his decision on the Brooklyn Edison Company:

> Passing on the constitutional questions raised, this indictment cannot stand unless defendant is one of those prohibited under Section 6 of the so-called Lever act from doing the acts there denounced. The defendant is not a wholesaler, retailer or other dealer in coal, nor is it a manufacturer within the meaning of Section 6. Defendant is a public utility corporation engaged in the manufacture, production and sale of electric light and power. It is a matter of common knowledge that the business of such corporations is subject to regulation by public service commissions or similar bodies. Such corporations are not in the same situation as uncontrolled private corporations or individuals. They owe a duty to the community to furnish light and power adequately and unceasingly, so far as practicable.
>
> To perform this duty they need coal, and exigencies and contingencies must be foreseen. I am of the opinion that Congress never intended that this discretion should be controlled or interfered with by this act, particularly in view of the many regulatory statutes, national and state, which relate either to public utility corporations or carriers, interstate and intrastate.
>
> Further, the phrase "public utility corporations" is well known both colloquially and technically. If Congress had intended to apply Section 6 to public utility corporations it could have so stated in simple language.
>
> But there is an even broader reason why "manufacturer" does not refer to corporations like defendant. The furnishing of light and power was vital to the country during the war. No one could foresee what might happen or be needed. It was the duty of a light and power public utility corporation to prevent so far as possible the shutting down or suspension of the service of light and power. Congress undoubtedly realized that it would interfere with and possibly impair the usefulness of such corporations as defendant if they were left at the mercy of Section 6 instead of subject to the regulation of the appropriate regulatory bodies.

Service Order No. 21 Not Meeting Utility Emergency Requirements

THE coal situation as it affects the public utilities grew worse rapidly during the week ended Nov. 6. George W. Elliott, secretary of the National Committee on Gas and Electric Service, laid the facts in the case before Commissioner Aitchison of the Interstate Commerce Commission on Nov. 8, but with the same result as that attained a week earlier. It was insisted by the utilities' spokesman that they must have assigned cars to insure sufficient supplies of coal to enable them to continue in operation. The Interstate Commerce Commission, however, seems to be firmly of the opinion that utilities can get coal if they try hard enough. Mr. Elliott asked Mr. Aitchison if the utilities can be expected to go on all winter under the strain of operating on such a narrow margin of coal supply as to make it problematical whether service can be maintained on the following day. He said that only good luck and constant effort on the part of utility officials had prevented numerous shutdowns of gas and electric plants. He failed to get a satisfactory answer from Commissioner Aitchison when he asked why service order No. 21 was issued if it were not intended to use assigned cars in cases of emergency.

While Mr. Elliott does not admit it, apparently the

co-operative agreement for supplying public utility needs is not meeting with full success. When a utility emergency is reported to the committee which is handling these matters, the railroad member of the committee requests the carrier to be sure that the coal operator supplying the utility has sufficient cars for the purpose. The operators' representative on the committee requests the producer to supply the coal to meet the emergency. In many cases the plan works perfectly, but in some cases the operators are said to fail in their compliance with the request and in other cases they cannot comply owing to lack of cars.

As there is evidence that spot coal will continue to sell for some time at a higher figure than most contracts call for, it is feared that the tendency to sell on the open market, rather than comply with the terms of the contract, will continue. Should the East and the Middle West experience severe winter weather in the next few weeks it is feared that a large number of public utilities will be forced to suspend operation because they have no reserve stocks of coal.

Society for Electrical Development May Form Local Organizations

THE Society for Electrical Development is considering the formation of local organizations affiliated with the society to carry on the development work. At the semi-annual meeting of the directors of the society on Tuesday it was felt that this was a move in the right direction, and accordingly a special committee was formed to work out the plans therefor.

Reports were made on the newspaper publicity work and on what is being done by the society to discourage publicity which might react unfavorably on the industry.

Another phase of the work commented upon is the compilation of data in regard to electrical fires. The statistics so far compiled, covering the greater part of the United States, show that less than 3 per cent of the fires in this country are caused by electricity and that more than half the fires designated as electrical occur out of doors, on poles, trolley cars and other places, and do not properly come under the definition of electrical fires, thus showing only a trifle more than 1 per cent of the total fires to be electrical in their origin. The general manager reported that the society's electrical Christmas campaign is so well supported by the industry that already more money has been received for the display material, booklets, etc., than was received either during "America's Electrical Week" or "Electrical Prosperity Week."

Henry L. Doherty was appointed to the board as a representative at large, and George Weiderman was appointed to serve the unexpired term of Ernest McCleary.

Arkansas Utility Men Co-operate with University in Metermen's Course

IN CO-OPERATION with the Arkansas Utilities Association the University of Arkansas conducted on Oct. 11 to 15 a special metermen's course consisting of a study of the fundamentals of direct-current and single-phase alternating-current circuits and meters. The course was similar in many respects to one given a short while before at the University of Illinois and described on page 142 of the July 17 issue of the ELECTRICAL WORLD. Another course, on polyphase circuits and meters, to be given next year is contemplated. Prof. W. B. Stelzna, who was in charge of the course, writes that it was well attended and that already one utility has decided to start night classes for its men.

Sheldon Memorial Exercises to Be Held Next Week

MEMORIAL exercises for the late Dr. Samuel Sheldon, professor of physics and electrical engineering at the Polytechnic Institute of Brooklyn, will be held in the auditorium of the Engineering Societies Building in New York City on the evening of Nov. 17. Addresses will be made by Dr. Arthur E. Kennelly, professor of electrical engineering at Harvard University; Dr. William H. Nichols, chairman of the corporation of the Polytechnic Institute; T. Commerford Martin, Bancroft Gherardi, vice-president of the American Telephone & Telegraph Company, and William N. Dickinson, president of the New York Electrical Society. Arthur W. Berresford, president of the A. I. E. E., will preside.

Electrical Supply Jobbers to Discuss Merchandising

TWO addresses on electrical merchandising, one by J. A. Corcoran of the publicity department of the General Electric Company and the other by M. C. Turpin of the merchandising bureau of the Westinghouse Electric & Manufacturing Company, will be made at the Thursday afternoon session of the semi-annual meeting of the Electrical Supply Jobbers' Association at Cleveland, Ohio, on Nov. 17, 18 and 19. How to obtain capital to finance the electrical jobbing business properly will be discussed on Friday afternoon by F. H. Goff, president of the Cleveland Trust Company. The remainder of the three sessions will be devoted to committee reports and routine business matters.

Ontario Government Rejects Proposal of Toronto Company

THE government of Ontario has rejected a proposal made by the Toronto & Niagara Power Company as a result of the situation reported in the ELECTRICAL WORLD for Oct. 30 (page 893). The company offered, on condition that the government should authorize the diversion of sufficient water, to develop 15,000 additional horsepower and to sell the energy thus produced at current contract prices and on the usual conditions. The Premier of the province said that the specific value of the electrical energy in question had been fixed at $9 per horsepower-year by a commission of judges. Inasmuch as the Toronto company had not been represented before this commission, the Premier offered to reappoint the commission to determine on a fair price, provided that the company would agree to furnish the power immediately.

Delegates from Toronto, Hamilton and other municipalities directly interested in the power shortage met in Toronto on Nov. 5 and again urged the Dominion authorities to refuse to allow the export of electrical energy from Ontario except under contracts made previously to 1920. The resolutions adopted favored the generation by the Toronto & Niagara Power Company of an additional 25,000 hp. for the use of the Ontario Hydro-Electric Power Commission. Sir Adam Beck announced that in a few days the commission would have another 15,000 hp. available.

Dominion Government Reduces Amount of Licenses to Export Power

AN ORDER in Council has been passed by the Dominion government reducing the amount of the export licenses of the Niagara hydro-electric companies as follows: Ontario Hydro-Electric Power Commission (formerly Ontario Power Company) from 45,000 kw. to 40,000 kw.; Canadian Niagara Power Company (controlled by the Niagara Falls Power Company of United States) from 40,000 kw. to 25,000 kw.; Electrical Development Company (controlled by the Toronto & Niagara Power Company) from 25,000 kw. to 15,000 kw.

The action of the Dominion government does not reduce the power at present being exported, but prevents the quantity being increased by any of the companies without the cognizance of the federal authorities. Chief Engineer F. A. Gaby of the Hydro-Electric Power Commission said that the export of power by the commission up to the amount named—40,000 kw.—must continue because of contracts.

New 45,000-Kva. Generator Relieves Detroit Power Emergency

THE new 45,000-kva. generator at the Delray plant of the Detroit Edison Company was started last week, and as a result the company is advertising that it is now able to fill the demands for electric supply and the request to lighting customers to use as little electricity as possible during factory hours is withdrawn. It is expected that the work of rebuilding an older 45,000-kva. machine will be completed early in December, still further relieving the Detroit situation.

Iowa Discussing Rural-Line Liability Insurance

LIABILITY insurance for rural lines and transmission lines is being discussed with the insurance companies by a committee of the Iowa Section of the National Electric Light Association formed for that purpose. This is a new phase of the insurance problem and has so far been a puzzling factor in the rural line situation, but it is believed that the insurance companies carrying power-plant risks are in duty bound to care in like manner for transmission lines. The committee does not expect the formulation of a definite plan until after a meeting of the insurance companies.

Senators Calder and Edge Threaten Federal Control of Coal Mining

ANNOUNCEMENT that unless the price of coal to the consumer shall have been materially reduced before Dec. 6 next they will recommend to the United States Senate that the government take over control of the coal industry was made last week by Senator William M. Calder of New York and Senator Walter E. Edge of New Jersey as a result of testimony produced before the Senate reconstruction committee, of which Senator Calder is chairman.

"The plain fact is," the Senator said, "that coal has not been reduced in price despite promises. The price of coal is away beyond what it should be and has been admitted to be so by the men who control the industry. "We are both strongly opposed to any form of government control, but the practical admissions of prominent coal men show that there is guilt among the men somewhere who have the power to regulate the price of the commodity. Now it is up to the industry to put its finger on those guilty and eliminate the unfair and illegal practices. It is up to them to solve this problem for themselves, but if they fail to do so the Congress must."

Northwest Electric Service League Indorsed

FURTHER details concerning the formation and objects of the Northwest Electric Service League and the report of the advisory committee thereon were presented to the executive committee of the Northwest Electric Light and Power Association in Portland, Ore., Oct. 14. It was the unanimous opinion of the executive committee that the Northwest Electric Service League can be the medium for closer co-operation of all branches of the electrical industry in the Northwest and that such co-operation will result in better service to the public, greatly increased use of electricity and electrical equipment, and the adoption by all the elements making up the industry of sound, ethical and progressive business methods.

First Move to Abolish Illinois Commission Made Two Days After Election

WITH a demand from Special Corporation Counsel Cleveland to withhold activities in pending cases of the Chicago Elevated Railroads, the Chicago Surface Lines and the Chicago Telephone Company, the city of Chicago on Nov. 4 apparently opened its fight to abolish the Public Utilities Commission of Illinois. One of the grounds stated for Mr. Cleveland's demand was that the election for Governor of Illinois has indicated the desire of the people of the state to abolish the commission and that it must be anticipated this will be accomplished at the earliest opportunity; therefore the commission should take no action that would result in fixing its decisions on the public after its abolishment.

Manufacturers' Co-operative Good Will Advertising Plans Shaping Up

MEMBERS of the manufacturers' advertising committee of the National Electric Light Association had up for consideration on Nov. 9 replies from many manufacturers who have pledged themselves to publish good-will advertising in behalf of the entire electric light and power industry. Many of these manufacturers have pledged at least one-twelfth of their advertising space during the coming year. The outstanding feature of progress is the number of smaller manufacturers who have responded.

Work will be begun immediately, and facts, figures, statistics and general policy matter will be outlined for the use of these manufacturers. The campaign will be so formulated that one main subject will be handled each month during the year 1921, so that at the conclusion of the year the twelve major points and problems in the industry will have been presented.

Suspension Insulator Case Against Ohio Brass Company Dismissed

AFTER ten years of litigation virtually involving the use of suspension insulators for power transmission purposes, Judge Lynch in the United States District Court of New Jersey has dismissed the complaint of the General Electric Company against the Ohio Brass Company without taking into consideration the validity of the patent. Contributory infringement of the Buck and Hewlett patent, No. 925,561, relating to "suspension of high-tension lines," was alleged.

At the time when high-voltage lines were becoming more common, about fifteen years ago, Buck and Hewlett conceived a system of periodic dead-ending of lines to cross-arms using a special type of disk insulator and employing a freely suspended jumper. No infringement of the Hewlett insulator was claimed, but merely of the system of line suspension. The patent stated that the system was for high-tension lines of from 60,000 volts to 100,000 volts.

The claims in issue were:

Claim 1.—In a system of high-tension-line suspension, the combination of periodically dead-ended spans joined by jumper connections, and intervening spans freely suspended beneath cross-arms of the supporting towers.

Claim 2.—In a system of suspension for high-tension power circuits, the combination of conductor spans dead-ended at the cross-arms through two chains of insulators flexibly connected to each other and to the cross-arm and a jumper connection between the adjacent ends of the spans and hanging freely by gravity beneath the cross-arm.

Claim 3.—In a system of high-tension-line suspension, the combination of periodic spans dead-ended on opposite side of a cross-arm or support through series of insulators flexibly connected and electrically connected by depending jumper wires, and intervening spans freely suspended beneath cross-arms of the respective supporting towers.

Claim 4.—In a system of high-tension-line suspension, the combination of spans each dead-ended to its cross-arm; through series of flexibly connected insulators, each series of connected insulators having flexible connection with the supporting cross-arm.

Claim 6.—In a system of high-tension-line suspension, the combination of towers provided with cross-arms of conductor spans freely suspended beneath said cross-arms by series of flexibly connected disk insulators.

The particular instance of infringement relates to the Sanitary District of Chicago, where pin insulators were primarily used. This system was to be enlarged by an additional 40,000-volt circuit. There was no room for three additional insulator pins, and therefore two of the additional wires were suspended. The defendant manufactured and sold the suspension insulators used, and this contributory act the plaintiff urged amounted to infringement.

It was pointed out by the court that all parts of the patented combination, including insulators, wires, poles, etc., and the practice of dead-ending were well known in the prior art and that the only invention, if any, was in their arrangement.

The court found that, while the patent claims were for 60,000 volts to 100,000 volts, the Sanitary District system was operated at 40,000 volts, and that the change to suspended lines was made only because there was no room for pin insulators.

Secondly, the court held that the patent called for periodic dead-ending, but in the specific case at issue—namely, that in the Sanitary District—there was no periodic dead-ending. The only dead-ending was at railroad crossings, and this practice was shown to have existed prior to the application for the patent. It was further shown that to avoid conductor swaying the periodic dead-ending was called for in the patent.

The claim relating to a jumper "freely suspended by gravity" was not allowed in the Sanitary District test case because the jumpers were rigidly connected by three-way clamps.

Finally, the court held that the patent allowed for free lateral swaying, whereas the defendant's insulators were so made as to prevent lateral swaying. Furthermore, the patent claimed to "do away with the usual insulators and their pins and provide at certain of the supporting towers a vertical series of insulators flexibly connected to each other, etc." It was shown that the connections between the defendant's insulators were rigid and also that the defendant's insulators were different, being of the cap and pin type.

Other transmission systems employing defendant's insulators for line suspension were offered in evidence, but the court stated that it failed to find that they resembled the system contemplated by the plaintiff's patent.

The court, in summing up, said:

"Should the court hold that selling, or offering for sale, insulators for a 100,000-volt system in itself amounts to infringement of a patent which calls for a specified use of those insulators in conjunction with a specified use of the other elements of the combination? I do not think so. The invention relates to a mechanical arrangement of instrumentalities by the patent description and claims, yet the interpretation asked is that the patent should be construed to cover and necessarily include features not embodied therein. This I cannot agree to."

Water-Power Projects Advertised

THE complete list of water-power projects advertised by the Federal Power Commission up to and including Nov. 8 is as follows: Ford Motor Company, Troy dam, New York; Crown Williamette Company, project near Oregon City, Ore.; Washington Irrigation & Development Company, Columbia River at Priest Rapids, Washington and Oregon; Luther Hill, Sawmill Creek, California; Pit River Power Company, Pit River, California; State of Illinois, Des Plaines and Illinois Rivers, Illinois; Dixie Power Company, White River, Arkansas and Missouri; Columbia Valley Power Company, Deschutes River, Oregon; Edison Company (Los Angeles), Big Creek, California; A. Reed, Bingham, Perdido, Styx and Black Water Rivers, Alabama and Florida.

Soft-Coal Prices Will Continue to Drop, National Coal Association Says

ESTIMATING the average output of soft coal now running at more than 12,000,000 tons a week, the National Coal Association, through its director of publicity, asserts that the prices in the bituminous mine fields throughout the country are on the decline. Within the last month there has been a drop in price of more than 25 per cent in many of the fields. The immediate soft-coal wants of the whole nation have already been met, the association says, excepting in a few isolated places. The prediction is made that, with a supply of cars which will enable the operators to turn out 12,000,000 tons of coal a week for weeks to come, prices in the market will continue to drop.

Dr. S. J. Meltzer of Electric-Shock-Resuscitation Fame Died on Sunday

DR. SAMUEL JAMES MELTZER of the Rockefeller Institute for Medical Research, discoverer of a new method for inducing artificial respiration, died at his home in New York last Sunday. Dr. Meltzer was probably best known to the electrical industry for his activities in connection with the prone-pressure method of resuscitation from electric shock now so generally used. He represented the medical profession on the Commission on Resuscitation from Electric Shock, which was started at the suggestion of the late W. D. Weaver, then editor of the ELECTRICAL WORLD.

Dr. Meltzer was born in Russia sixty-nine years ago and came to this country in 1883. Since 1906 he had been at the head of the department of physiology and pharmacology at the Rockefeller Institute.

In commenting on the death of Dr. Meltzer, W. C. L. Eglin, chief engineer of the Philadelphia Electric Company, who was associated with him on the commission, said:

"We of the electrical industry feel very grateful to Dr. Meltzer for the work which he did while serving on the commission on resuscitation from electric shock, in which the late W. D. Weaver, editor of the ELECTRICAL WORLD, took a personal interest for so many years. All of the members of this commission served without any financial remuneration and gave of their time and experience without stint in this broad humanitarian work. From the inception of Dr. Meltzer's connection with this commission he continued his interest and activities, and he did much to increase knowledge of this subject."

Southern California Company Advocates an "Equalizing Reserve"

A NOVEL element has been brought into the hearings before the California Railroad Commission in connection with the application to establish regular rates for the Southern California Edison Company by the company's argument that its ability to carry out its building program should have a place in establishing a rate base alongside the customary historical value of past investments. The company contended that the completion of the Big Creek program on schedule time and to the best economic advantage demands a steady flow of new money into the enterprise and that this flow must not be interrupted by frequent rate changes which ordinarily would arise from emergency conditions.

For the purpose of avoiding such possible rate adjustments the company proposes a new item in its financial statement to be called an "equalizing reserve," which would be established in the first instance by a voluntary contribution from earnings. Once established, the fund would be increased in years of favorable operating conditions and would be drawn upon when the circumstances were reversed. The plan does not contemplate adjustments to meet general fluctuations in commodity prices, but merely the meeting of unusual and unforeseen conditions such as "dry" years, enhanced labor costs and serious accidents to plant.

In addition to the equalizing reserve it is proposed to establish a "reward for efficiency" account which would be in the nature of employees' participation in earnings. It is held that this fund would be readily maintained without cost and with profit to the consumer, as it would result in a degree of personal efficiency heretofore unknown in the public utility field.

This hearing, which was held at Los Angeles, was in resumption of a previous hearing (see ELECTRICAL WORLD for Oct. 9, page 748) at which Vice-President R. H. Ballard of the company advocated a new basis for rates based on necessary financial obligations.

Issue of Permits to Pit River Company Not Inimical to Nation's Interests

QUESTION as to whether the issuance to the Pit River Power Company of a permit or a license would diminish the right of the United States to the ownership of certain lands in dispute was settled by the Federal Power Commission on Nov. 8, when it agreed with the solicitor of the Department of the Interior that the application could take its usual course without affecting national interests. The commission also approved the ruling of its chief counsel to the effect that the head of a department who may have issued a preliminary permit prior to the passage of the water-power act has no right to extend the life of the permit. Extensions must come through the Federal Power Commission.

It was further determined that the extension of the period for the completion of the project authorized by a final permit issued under the act of Feb. 15, 1901, is within the jurisdiction of the head of the department which issued the permit. Unless the applicant applies for a license to the Federal Power Commission, that commission is without jurisdiction in the matter. Another ruling was made to the effect that there can be no transfer of a special-use permit. The would-be transferee must indicate whether or not he desires a permit under the water-power act.

The Commission decided that the nine Niagara and St. Lawrence River projects should be advertised, and the chief counsel was instructed to look into the jurisdiction of the International Joint Commission over developments involving the Niagara River.

Power Shortage Holds Back Development of Electric Heating Applications

ONE deterring influence in the development of electric heating applications is the shortage of power in industrial plants or the central stations supplying those plants. This point, as well as unanimity of opinion that electric heat-treating processes are very satisfactory, was brought out in the discussion of the subject at the Philadelphia Section meeting of the Association of Iron and Steel Electrical Engineers on Nov. 6.

All rivet heating for both the passenger-car and freight-car department of the American Car & Foundry Company at Berwick, Pa., is handled with electric rivet heaters, according to a statement by J. R. Bower, assistant master mechanic. A total of 102,000 rivets are heated daily, representing 45,739 lb. (20,746 kg.) of steel. The energy required is 6,370 kw.-hr., or 14 kw.-hr. per 100 lb. (45.3 kg.) of rivets. The saving shown over oil heating is from $1 to $2 per 100 lb. of rivets.

Electric heat treating was dealt with by George P. Mills, electrical engineer of the Electric Furnace Construction Company, while oil furnaces were covered for comparison purposes by James E. Wilson of the Treadwell Engineering Company.

Current News and Notes

Timely items on electrical happenings throughout the world, together with brief notes of general interest.

Development of the Rhone River from Lake Geneva to the Sea.—Plans are under consideration for the development of the Rhone River from Lake Geneva—Lac Leman—at Geneva, Switzerland, to the sea. The proposed work includes water-power development, navigation and irrigation projects. The French Parliament, it is expected, will soon authorize the undertaking.

National Research Council Gets Site for New Building.—A site in Washington for the new building which is to serve as a home for the National Academy of Sciences and the National Research Council has recently been obtained. It comprises the entire block bounded by B and C Streets and Twenty-first and Twenty-second Streets, Northwest, and facing the Lincoln Memorial in Potomac Park.

Central-Station Co-operation in New England.—Visits to central stations will form an important part of the committee work of the New England Geographic Division, N. E. L. A., during the coming year. Besides holding meetings in various parts of New England for informal discussion of committee matters, individual calls will be made upon local companies to facilitate the interchange of data and better coordinate divisional affairs.

Electrical Engineering Students at Rensselaer Polytechnic Institute.—More entering students at the Rensselaer Institute, Troy, N. Y., have enrolled for the electrical engineering course than for any other course. During the war it was the chemical engineering course that proved the most attractive. The number of freshmen this year is 385, apportioned as follows: Civil engineering, 104; electrical engineering, 108; mechanical engineering, 89; chemical engineering, 74; special, 9; bachelor of science, 1.

Long-Distance Transmission in British Columbia.—The West Kootenay Power & Light Company of Rossland, British Columbia, has completed its transmission-line extension from Greenwood to Allenby, a distance of 100.1 miles. The line is one of the longest in western Canada, the total distance from the power house at Bonnington being 195 miles. The new extension has been constructed for 110,000-volt transmission, but for the present is connected with the old 50,000-volt system. The anticipated load at Allenby is about 3,000 kw., which will be used for mining and milling by the Canada Copper Corporation.

Proposal to Transmit Electricity Direct from Belgium to Italy.—Professor Guarini, an Italian engineer, has suggested that instead of sending coal from Belgium to Italy by railway it should be possible to utilize it to generate electricity for transmission direct to Italy. The distance, as the bird flies, between the Belgium mining centers and Lombardy, for instance, does not exceed 750 miles.

Electrification of State Railways in Austria.—The Water Power and Electricity Commission, a recently formed Austrian body, has decided to limit the equipment of the state railways for electrical operation for the present to some section of the western lines of what remains of Austria. The cost of the proposed work is estimated at 5,100,000,000 kronen. By the adoption of hydro-electric power it is hoped to save the state 434,150 tons of coal annually, out of a total of 3,500,000 tons available for the railways of the country.

Enlarging Prospect Plant of California-Oregon Power Company.—Extensive additions to its high-head plant at Prospect, Ore., on the upper Rogue River, are to be started before long by the California-Oregon Power Company. The plan calls for the construction of a concrete dam, 1¼ miles of canal and a forebay with a surface area of about 10 acres. From this forebay water will be conducted through 3,000 ft. of high-pressure pipe to a new power house of reinforced concrete and steel which is to take the place of the present frame structure. The new plant is to develop 20,000 kw., the aggregate of four units.

Nearly 800 California Utilities File Reports.—There are 798 public utilities in California filing annual statements with the Railroad Commission, according to the annual report of the commission for the year ended June 30. Seventy electric companies, thirteen gas and electric companies, thirty-four electric railways and 106 telephone companies are included. The increase in the number of formal complaints filed over the number received in the preceding year was 63.7 per cent. In informal matters the number of complaints filed totaled 2,663, as against 2,342 the preceding year. The commission held 941 public hearings and rendered 1,349 decisions, 406 more than were handed down in 1918-19, and 257 more than were given in 1917-18, the record year up to the present.

Associations and Societies

A complete Directory of Electrical Associations is printed in the first issue of each month.

Indiana State Electrical Contractors and Dealers' Association.—This association will hold its next meeting in South Bend, Ind., on Dec. 1 and 2.

A. I. E. E. and A. S. M. E.—A joint meeting of the New York Section, A. I. E. E., and the Metropolitan Section, A. S. M. E., will be held on Dec. 3, with Frederick Darlington in charge. topic, "The American Power Problem."

A. S. M. E. Organizes Materials-Handling Section.—Four hundred members of the American Society of Mechanical Engineers have organized themselves into a professional section on materials handling. This section will provide a common channel of intercourse between all the technical and industrial organizations co-operating in the solution of engineering problems connected with the handling and distribution of materials and products.

Ohio Electric Light Association.—The meter committee of this association met at Columbus on Nov. 11; the transmission and distribution committee will, it is announced, meet in Cleveland on Nov. 18, and the illumination committee and the new-business co-operations committee in Cleveland on Dec. 1, instead of Nov. 17, as at first intended. At the last-named meeting industrial lighting and sales methods will be discussed under the leadership of J. B. Wilson.

Iowa Electrical League.—A society with this name was formed with fifteen charter members at the recent semi-annual convention of the Iowa Association of Electrical Contractors and Dealers at Waterloo by wholesale-house and manufacturers' representatives selling electrical supplies in the state. The membership is to include any person directly or indirectly interested in the electrical business in Iowa. Temporary officers were elected as follows: President, F. A. Rhode, Marshalltown; secretary, C. M. Knape, Cedar Rapids; treasurer, K. H. Bloodgood, Des Moines. H. E. Mason of Chicago is chairman of the "boosters'" committee.

Coming Meetings of Electrical and Other Technical Societies

Electric Power Club—Hot Springs, Va., Nov. 15-18.
Florida Ice and Public Utilities Association—Miami, Fla., Nov. 15 and 16.
National Electric Light Association—Southeastern Geographic Division, Miami, Fla., Nov. 17-19. (For program see issue of Oct. 23, page 845.)
Electrical Supply Jobbers' Association—Cleveland, Nov. 17-19.
American Engineering Council—Washington, Nov. 18-20. (For program see issue of Sept. 25, page 651.)
Jovian Order—St. Louis, Nov. 25 and 26.
American Physical Society—Cleveland, Nov. 27; annual meeting Chicago, Dec. 28-Jan. 1.
Indiana State Electrical Contractors and Dealers' Association—South Bend, Dec. 1 and 2.
A. I. E. E. (New York Section) and A. S. M. E. (Metropolitan Section)—Joint meeting, New York, Dec. 3.
Association of Iron and Steel Electrical Engineers—Philadelphia Section, Dec. 4; Cleveland Section, Dec. 13.
Rivers and Harbors Congress—Washington, Dec. 8-10.
Illinois State Electric Association—Chicago, Dec. 9. (For program see issue of Nov. 6, page 942.)

Commission Rulings

Important decisions of various state bodies involving or affecting electric light and power utilities.

Purchased Energy in Relation to Rates.—An electric company which purchases its energy will not be permitted by the Wisconsin Railroad Commission to increase its rates to its consumers upon the ground that its contract for purchasing electricity is terminable at will and that it will in the future be obliged to pay more for the energy purchased.

Solvency of Company No Reason for Operation at Loss.—The mere fact that the assets of a utility exceed its liabilities by a considerable sum is no reason, in the opinion of the Massachusetts Department of Public Utilities, why the utility should be required to operate at a loss for a substantial period of time, particularly where for twenty years the dividends upon the capital stock have averaged only 4.75 per cent.

Losses in One Department Must Not Be Recouped from Another.—The Georgia Railroad Commission in passing upon the application of the Georgia Railway & Power Company for increased rates reiterated its opinion, often expressed before, that losses, if any, or inadequate returns, if such, in one department of a public utility, as a street railway, should not be saddled upon the patrons of another department, as electric light or gas. Hence it made an effort to ascertain the fair value of the property used by the applicant in its railway department and the financial results of its operation without regard to the electric light and power and other departments of the company's business.

Right to Discontinue Service to Delinquent Customers.—The right of a public utility to discontinue service for non-payment of amounts justly claimed for service rendered is recognized by the New Jersey Board of Public Utility Commissioners, because it is in the interest of the public as well as the utility that the enterprise shall be conducted without unnecessary waste. This involves a minimum of loss through bad accounts. Material losses through failure to collect accounts or continual bringing of individual suits to enforce payment of numerous small accounts of delinquent debtors would in time be reflected in the rate charged for service. Nevertheless, the commission refused to sanction the action of a gas company in refusing service to one who had discontinued it sixteen years ago and, according to the company, still owed it money, suit for which, although the debtor was a property owner, had never been brought.

Classification of Service in Reference to Rates.—The United States Shipping Board Emergency Fleet Corporation having complained against a tariff supplement of the Delaware County Electric Company whereby in its schedule of rates an upper limit was placed upon the use of alternating current untransformed, the Public Service Commission of Pennsylvania found that the limitation placed upon the rate was a reasonable one, in view of changed operating conditions and changed load characteristics, but that the company should have provided an intermediate rate for demands in excess of the limitation so fixed.

Kansas Industrial Court on Its Relations to Capital and Labor.—In passing on a street railway wage case, the Kansas Court of Industrial Relations made these observations on its functions and obligations: "This court is very desirous to do nothing in this case that will unduly burden the respondent. However, it must be admitted that wages to labor should be considered before dividends to the investor and that a business which is unable to pay a fair rate of wage to its employees will eventually have to liquidate. The Kansas law imposes upon this court the obligation, so far as it has the power to do so, to assure to labor a fair wage and to capital a fair return. . . In order to insure skilled and faithful workers in these [essential] industries a fair wage must be paid and healthful and moral surroundings provided; otherwise workers of the highest skill and fidelity would seek employment in other industries. But it is also necessary that capital invested in such essential industries should be assured a fair return. Otherwise such industries would languish for want of capital and the public would suffer as a result."

Rates in Relation to New Capital Requirements.—In granting to the Georgia Railway & Power Company increased rates intended to bring a return of 8 per cent, out of which fixed charges must be met, the Georgia Railroad Commission said: "The record shows that there is a large demand on applicant for services, especially for industrial power, which it cannot meet without further development of unused water powers, and that large sums of new capital are necessary for such additional developments. Because of financial conditions now existing, it shows that it has been unable to secure needed capital from the sale of its bonds or from short-term loans except at very high rates of interest and only in limited amounts. New capital cannot be obtained by public utilities at all except where rates are such as will afford reasonable assurance, with efficient management, of earnings sufficient to care for legitimate fixed charges and establish for them a basis of credit. This does not mean that rates should be such as in themselves will supply new capital, but that they be such as to justify capital investments in competition with other business ventures."

Recent Court Decisions

Findings of higher courts in legal cases involving electric light, power and other public utility companies.

Definition of "Proximate Cause."—The Court of Errors and Appeals of New Jersey has thus defined "proximate cause" in a damage suit (Kelson vs. Public Service Railway Company): "The 'proximate cause' is that cause which naturally and probably led to and which might have been expected to produce the result. It is the efficient cause, the one that necessarily sets the other causes in operation." (110 At. 919.)

A Broken or Fallen Charged Wire in Street Presumptive Evidence of Negligence.—In a suit to set aside damages granted for death resulting from contact with a broken wire charged with electricity (City of Thomaston vs. Atkinson), the Court of Appeals of Georgia held that it was for the jury to decide every disputed issue of fact, including that of whether the deceased was walking on a public path and whether he was guilty of contributory negligence. Upholding the original verdict, it declared that a broken or fallen wire in a street charged with a dangerous current of electricity affords a presumption of negligence on the part of the owner of the wire. (103 So. 876.)

Duty of Power Company to Servants of Telephone Company Using Same Street.—The Court of Appeals of Kentucky has denied a rehearing in Louisville Gas & Electric Company vs. Beaucond, thus affirming the verdict of the lower court awarding damages to Beaucond for injuries received while working for a telephone company whose wires were strung from poles erected nearly in line with those of the power company. The injured man claimed that his foot came in contact with the power company's lines and that the shock received forced him to lose his hold and to fall to the ground, 30 feet below. The Court of Appeals found that the power company had acquiesced in the proximity of the telephone wires to its own wires and that it therefore became the power company's duty to exercise every care to protect servants of the telephone company from the electric service wires. The cause of the man's fall was a question for the jury, as was that of contributory negligence, the case being one where ordinarily reasonable men might differ. The alleged concurring negligence of the telephone company did not affect the liability of the power company, the lineman being free to proceed against one or both of them or to settle with one and proceed against the other. (224 S. W. 179.)

Men of the Industry

Changes in Personnel and Position—Biographical Notes

L. W. Chubb, a well-known research engineer with the Westinghouse Electric & Manufacturing Company, has been appointed manager of that company's newly created radio engineering department. Mr. Chubb has been engaged in both theoretical and practical work with the Westinghouse company for fifteen years. He joined the company as a student engineer immediately after graduation from Ohio State University in 1905. During the past year Mr. Chubb has been conducting special studies in the material and process engineering department. Before that for more than ten years he was in charge of the electrical section of the research division of the engineering department. For many years Mr. Chubb has been an active member of

L. W. CHUBB

committees of the A. I. E. E., and at present he is a member of the meetings and papers committee, standards committee and electric physics committee of the Institute and of the United States national committee of the International Electrotechnical Commission. In the fall of 1919 and the spring of 1920 he was sent to London and Brussels respectively as one of the American delegates to the meetings of the I. E. C. He has received patents on nearly one hundred inventions in almost every phase of electrical engineering.

Major Howard S. Bennion of the Corps of Engineers has been assigned to the Federal Power Commission to act as office executive for the engineering section of the commission. Major Bennion was in charge of the camouflage service in France during the war.

G. R. Kenny, until recently statistician and valuation engineer for the San Joaquin Light & Power Corporation, has joined the engineering staff of Ford, Bacon & Davis in valuation, report and special investigation work. Mr. Kenny prior to his connection with the San Joaquin Light & Power Company was assistant engineer for the Railroad Commission of the State of California.

R. F. Hayward has resigned the post of general manager of the Western Canada Power Company, Ltd., Vancouver, B. C., to become manager of the Santiago Light, Tramway & Power Company, Santiago, Chile. Mr. Hayward, who has had a long experience in electrical work, came from England in 1894 and became general manager of the old Salt Lake & Ogden Gas & Electric Light Company, Salt Lake City, Utah. In 1897 he became chief engineer of the Utah Light & Railway Company, in which position, until 1905, he was active in the construction of many of the pioneer projects of that vicinity. From 1905 to 1909 he was general manager of the Mexican Light & Power Company, Mexico City. Since 1909 he has been chief engineer and general manager of the Western Canada Power Company, for which he designed and constructed the Stave Lake development. He is a fellow of the American Institute of Electrical Engineers and a member of the American Society of Civil Engineers.

A. R. Kelley has been appointed engineer of estimates and valuations of the Southern California Edison Company. This is a newly created department, and Mr. Kelley will report directly to the vice-president in charge of construction and operation. Mr. Kelley was born in Urbana, Ill., in 1878 and was graduated from Purdue University in 1903. He then spent two years in the apprentice course of the Western Electric Company, Chicago. Following this he was local manager with the Delaware & Madison Counties Telephone Company, Anderson, Ind., for one year; local manager of the Citizens' Telephone Company, Columbia City, Wash., for three years, and electrical engineer of the Seattle, Renton & Southern Railway, Seattle, for one year. He then spent two and one-half years in appraisal work in Seattle, during the latter part of this time being assistant engineer of the Public Service Commission of Washington. He then became electrical engineer of the Railroad Commission of California, specializing in rate investigations, valuations and condemnation proceedings. Since 1914 he has confined himself to a private consulting practice on rate cases and valuation proceedings, and he has numbered among his clients many of the California utility companies. During the war he was captain of engineers and assistant to Major-General Seever, Pacific Coast Power Administrator.

H. H. Barnes, Jr., district engineer of the General Electric Company in New York in charge of engineering and construction, has been appointed assistant district manager in addition to his other duties. Mr. Barnes was born in New York City Dec. 15, 1875, and was graduated in electrical engineering at the Polytechnicum in Stuttgart, Germany, in 1897. For a year and a half he was engaged in special testing for Siemens & Halske in Charlottenburg. He then went to Mexico City for that firm in 1899 as superintendent of the Compañia Mexicana de Electricidad. In 1902 he joined the staff of the Stanley Electrical Manufacturing Company, Pittsfield, Mass., and later became manager of its engineering department. Mr. Barnes left Pittsfield to

H. H. BARNES, JR.

act as consulting engineer for the General Electric Company in New York and one year later became district engineer. He is a member of the American Institute of Electrical Engineers, American Society of Mechanical Engineers and a number of other engineering societies, and for a number of years represented the A. I. E. E. on the board of trustees of the United Engineering Society.

R. S. Gereford has been appointed manager of the Hempstead (Tex.) Light & Power Company and assumed charge soon after Oct. 1.

George F. Brockman has been appointed superintendent of the municipal light and power plant at Albany, Tex., and will also be in charge of the construction of a new plant at Moran, Tex. During the war Mr. Brockman served in the United States Navy as electrician overseas. After his return in February, 1919, up to July, 1920, he served as chief electrician of the United States government's air service at Washington, D. C. Mr. Brockman, who also served in the Spanish-American War, is one of the oldest construction engineers in the country, having started with the General Electric Company in the year 1889.

Trade and Market Conditions

News of the Trade for the Manufacturer, Wholesaler and Jobber of Electrical Equipment and Supplies—Notes on Industrial Activities and Business Methods

Schedule Material Manufacturers Busy

MANUFACTURERS of schedule material, while somewhat short of new business, are still actively engaged in production. Many back orders are being filled, especially along the line of specialties which were hard to manufacture earlier in the year on account of difficulties connected with raw material and transportation. One of the largest establishments has orders enough on its books to run its plant to Jan. 1, and while a good many requests from jobbers that shipments be postponed are coming in, cancellations have not as yet assumed serious magnitude. A few employees are being laid off in the switch and socket branch of the industry, and little additional help is being taken on. There is an evident disposition on the part of manufacturers to consider the jobber's situation from a co-operative standpoint, and some factory stocks of wiring devices, notably sockets of various types, are being built up pending a resumption of a more active demand for these products. Deliveries are therefore unusually prompt, except in a few lines, where for the reasons above mentioned special devices have not been produced on the normal scale.

Heating Appliance and Range Situation in San Francisco

PRICES of household heating appliances have remained steady in San Francisco for the past three months, but there are now daily expectations of serious changes. This feeling has been intensified by a recent telegram from the Westinghouse Electric & Manufacturing Company to those dealers who had placed protection orders for radiators with that company. This telegram stated that all prices on heating appliances and household material were withdrawn and were being replaced, but so far the new prices have not been announced. About ten days before this telegram was sent the same company addressed a letter to its radiator customers stating that it would prefer to fill their future orders immediately, because of the possibility of a serious price advance and the likelihood of there being no stock when the time of delivery came. Local electric iron stocks of all makes are excellent, and the opinion is that the high list prices are responsible for the present depression in iron sales. Other heating appliances, such as grills, toasters and small toaster stoves, are needed badly, as the stocks en route will certainly not suffice for the Christmas season. The percolator situation is a little better than previously, as there are plenty of the pot styles in stock, although there is still a shortage in certain makes of the urn models.

An exceedingly brisk heater season is expected. The recent power shortage extended only to street lighting, sign lighting and other special regulations, such as the skip-stop street railroad rules in San Francisco, and the various power companies state that they are prepared to accept radiator and even range business without fear.

Although no organized campaigns are being made on electric ranges by the power companies, a surprising amount of business has developed through the effort of scattered dealers. It may be safely said that the present high prices on ranges do not hurt sales, because customers seem to know plainly what types they want and are anxious to get them. Certain jobbers report that some styles are slow-moving, and it is found that it is hard to substitute when customers have once decided on a certain type. A great deal of government business is expected during the coming year, and resorts are now placing their orders for spring delivery, because of the long time required by the factory to complete such orders. Jobbers are ordering in carload lots.

The Pacific Gas & Electric Company has just issued a new range rate which reads as follows: First 180 kw.-hr. on separate meter for ranges and water heater, 3½ cents per kilowatt-hour; thereafter 2 cents per kilowatt-hour. As the irrigation load has now almost entirely dropped off the power companies' lines, owing to the winter rains having begun, the shortage of power is relieved. The companies will now turn to this class of business in anticipation of being prepared to carry it through next year as extensive additions to the generating plants are being made.

September Electrical Exports Holding Up Well

ELECTRICAL exports for the nine months ended September, 1920, total $68,329,414, the month of September furnishing $7,307,068, according to figures of the Bureau of Foreign and Domestic Commerce. This total is still slightly behind the figure of $68,414,360 for the same period in 1919, but well above the corresponding total of $43,737,320 for 1918. A significant feature of the present year's exports is that since June the total for each month has been larger than the corresponding month in 1919. This excess in July, August and September amounts to almost $2,000,000, so that if the present ratio is maintained, electrical exports for the year 1920 should exceed the figure of approximately $90,000,000 registered last year.

The small difference between the total exports for 1919 and 1920 to date is attested by the fact that this year has recorded a larger figure on ten items, while 1919 is ahead on nine. The largest excess thus far this year has been about $1,000,000 on motors, as well as approximately $750,-

			—Nine Months Ended—	
	Sept., 1919	Sept., 1920	Sept., 1919	Sept., 1920
Batteries	$442,588	$607,936	$4,606,695	$4,885,262
Carbons	72,816	119,233	1,107,227	1,085,831
Dynamos and Generators	525,040	461,673	4,145,933	4,655,037
Fans	49,768	70,489	1,240,808	930,990
Heating and cooking apparatus	91,881	95,986	1,187,296	1,260,863
Insulated wire and cables	301,315	635,641	7,269,804	5,298,293
Interior wiring supplies	146,729	241,042	1,730,509	2,334,168
Arc lamps	374	1,053	12,160	17,376
Carbon-filament lamps	10,861	4,402	138,343	70,955
Metal-filament lamps	358,396	244,047	3,774,211	2,756,484
Magnetos, spark plugs, etc.	226,843	271,177	2,341,437	2,664,864
Meters and measuring instruments	208,496	190,331	2,269,620	1,868,300
Motors	733,891	1,230,408	7,845,643	8,899,123
Rheostats and controllers	38,326	33,309	375,116	1,161,604
Switches and accessories	339,188	281,635	2,771,659	3,047,824
Telegraph apparatus	31,262	38,093	707,407	481,434
Telephones	199,936	246,841	2,691,137	2,594,939
Transformers	153,508	208,493	3,113,812	2,980,456
All others	2,188,370	2,325,279	21,085,543	21,335,611
Total	$6,119,588	$7,307,068	$68,414,360	$68,329,414

000 on rheostats, $500,000 on interior wiring supplies, $333,000 on magnetos and about $250,000 on switches. On the other hand, 1919 has up to date registered higher totals on insulated wire and cable by about $2,000,0000, on tungsten lamps by more than $1,000,000, and there was about $400,000 excess on meters.

The export total of $7,307,068 for September, 1920, is more than $1,000,000 ahead of the figures for September, 1919. It is about $500,000 behind the exports for the previous month this year, however, and falls slightly below

the year's average to date. No records were made in September, the exports of each of the nineteen different items having been exceeded by previous months this year. The increase of about $1,200,000 over the September, 1919, exports is largely accounted for by an excess of about $500,000 on motors, $333,000 on insulated wire and cable and about $166,000 on batteries.

Improvement Shown in British Electrical Labor Market

RECENT advices from the British Consulate-General in New York throw light on the condition of the labor market in the electrical trade in England. It seems that although at the time of writing labor unrest continues in certain sections of industry, there is undoubtedly a justifiable reason for some measure of optimism in view of the settlement of the electricans' dispute, which threatened not only to dislocate the electrical industry, but also to involve practically all branches of engineering.

The general position has shown a very marked improvement over the situation at the close of September. The home trade has naturally improved now that this particular threat of labor trouble is removed and demand reaches a fairly satisfactory volume.

Possibly the only really disappointing feature is the continued difficulty in securing export orders. One of the main hindrances to the development of a satisfactory volume of overseas trade, not only in the electrical but also in many other trades, has been the great difficulty in quoting firm prices. The instability of prices which has been so pronounced during the past two years and the consequent reservation by making quotations subject to subsequent advances in price have undoubtedly been responsible for the loss of many orders which would otherwise have been placed in England.

Considerable thought has been given by this industry to means for overcoming this difficulty, and the latest development in this direction is decidedly interesting. Efforts are now being made to have such contracts underwritten as regards the possibilities of increased costs of production subsequent to the quotation of prices. A solution along these lines would go far toward removing present difficulties and enabling exporters to quote firm prices.

Production of Conduit Still Six to Seven Months Behind Orders

CONTRARY to the general rule of increasing stocks and slackening demand in most lines at present, the market for rigid conduit, according to several large manufacturers, remains greatly undersupplied. In most cases demand is said to be holding up as strongly as ever, but in at least one instance the volume of orders has fallen off on the large sizes though the commonly used ½-in. and ¾-in. conduit is said to be scarce.

Manufacturers for the most part are far behind in filling orders. The chief reason advanced for this is a serious shortage of cars. This has not only impeded deliveries but in many instances has prevented manufacturers from obtaining pipe that is badly needed for the making of conduit. The pressing needs of coal transportation are held responsible for the inability to obtain cars. One manufacturer reports that as a result of shipping troubles his supply of pipe is only about 25 per cent of normal, and another at one time recently was able to get only one-tenth the number of cars needed.

In general producers are still struggling to catch up with back orders. Manufacturers' stocks are virtually nonexistent. Several large interests are accepting no new orders at present, and the average length of time for which production is completely booked up is probably about six or seven months. Deliveries are said to be very uncertain, and little relief is seen in that respect in the near future unless the transportation situation greatly improves. Some jobbers here and there report sizable stocks of conduit on hand, but these cases seem but instances of fortuitous arrival of shipments long ordered.

A few cancellations are reported, due to pyramiding of orders, but this practice has not been general in the conduit market. The consensus of opinion holds that prices in this line have reached their peak but that no fluctuation may be expected for some time to come. Lower prices of pipe by the leading steel interests might affect the finished product, one large producer says, but little likelihood of this is seen as yet. Labor conditions are, it is said, improved to the extent that more discrimination can be used in hiring men owing to a greater number of applicants.

Collections in Northwest Long

IN TRACING conditions of credits and collections in the electrical field in the Northwest it is shown that there is much room for improvement. Recent reports give lengthening terms of collections from the dealer trade, small dealers ranging from sixty to ninety days and in some cases going as long as 180 days. In several cases where their assets exceed their liabilities they are unable to realize on these assets because of slow collections. At the same time, collections in other branches of the trade are in much better condition, a good majority averaging less than sixty days. Some large industrial accounts are paying in thirty days but lumber companies are slow because of the slump in business.

Farmers are not buying because crops, from wheat to prunes, instead of being one-third greater than normal, as was expected, are reported less than normal. Heavy rains and hail have done much damage. With the price of wheat falling, the farmers hesitate to sell and are holding for better prices. Bankers are refusing to loan money on this wheat and the farmers have no cash. Consequently sales of lighting plants and appliances to this trade have suffered considerably and will fall far below the expected volume.

Metal Market Situation

A SLIGHTLY better tone prevails in the copper market. Large producers firmly hold to their 15-cent level for copper delivered over the rest of this year, and their position seems improved. A number of sales are reported at this price, and inquiries are also noticeably greater in the outside market, which is quoting on a level with producers. It is doubtful if any sales are being made under 15 cents by dealers, however, for offerings of second hands are not large. Many of the dealers are reported as entering the market as buyers rather than sellers, lending color to the belief expressed in some quarters that copper has reached its low limit. For shipment over the first quarter of next year, the price averages 15¼ cents delivered, but most of the present inquiries are for nearby shipment.

On the whole the non-ferrous metals market reveals a much steadier tone the past week than has been the case recently. Tin, however, developed weakness and declined slightly, as well as sheet zinc. Scrap-metals prices are firmer.

NEW YORK METAL MARKET PRICES

	—November 1—	—November 8—
Copper	£ s d	£ s d
London, standard spot	91 0 0	90 5 0
	Cents per Pound	Cents per Pound
Prime Lake	Nominal 15.50	Nominal 15.50
Electrolytic	15.00	15.00
Casting	14.50	14.50
Wire base	17.50–18.00	17.50–18.00
Lead, trust price	7.25	7.25
Antimony	6.37½	6.25
Nickel, ingot	43.00	43.00
Sheet zinc, f.o.b. smelter	12.50	11.50
Zinc, spot	7.40	7.40
Tin	40.00	37.62½
Aluminum, 98 to 99 per cent	32.90	32.90

OLD METALS

	Cents per Pound	Cents per Pound
Heavy copper and wire	12.00–13.00	12.00–13.50
Brass, heavy	6.50– 7.00	6.50– 7.00
Brass, light	5.00– 5.50	5.00– 5.50
Lead, heavy	5.25– 5.50	5.25– 5.50
Zinc, old scrap	4.00– 4.50	4.00– 4.50

THE WEEK
IN TRADE

ALMOST without exception buying in the jobbing field is continuing at a curtailed rate. More sales effort is being required to move the materials which are coming in from manufacturers at a rate that is filling up jobbers' shelves. Little activity is found in the building market except in the South, and consequently the demand for wiring supplies is not sufficient to move the stocks which jobbers have acquired in the last few weeks. On the other hand, the volume of alteration work is good and is keeping a good quantity of wiring material moving.

White conduit supply has not caught up. Stocks of black are building up in good shape and in general are found in pretty fair supply, the smaller sizes being hardest to get. Porcelain is back on the market in good quantity along with loom and flexible armored conductor. Wire is plentiful. While heating appliances as a whole are in pretty good supply, there are short stocks of hollow ware. There is little difficulty in filling orders for washers and cleaners.

In the Western States collections are showing more favorable reports than in the East and Northwest. At the same time it is necessary to devote much effort to improve conditions in this direction.

NEW YORK

A curious situation exists in that while many jobbers are finding business extremely slow and are saddled with large stocks some houses are very optimistic regarding their condition. The view is constantly heard that "we can't kick; sales have fallen off considerably but demand is still fairly good." In some of these cases it is admitted, however, that greater effort must be devoted to making sales. In spite of this, more than one jobber reports both a very encouraging volume of sales and a fairly low inventory level. Less talk is heard of price cutting. Cancellations, so far as can be learned, are not being received in an alarming degree. Collections, however, remain as bad as ever.

Building contracts for October in New York State and northern New Jersey, according to the Dodge reports, totaled $49,207,000, which represents a decline of $10,000,000 from the September figure. This decline is held partly to blame for the light demand in nearly all sorts of wiring material, though conduit, porcelain, radiant heaters and appliances are moving well.

Tape.—Demand is fairly good. Stocks are large but not excessive. Friction tape in 100-lb. lots is worth about 54 cents, with rubber ranging 2 cents per pound higher.

Metal Molding.—The three-wire and four-wire size is quoted at from $67 to $68.50 per 1,000 ft. by jobbers. Demand is reported light and stocks vary, in some cases being much too heavy.

Conduit.—Demand is maintained at a surprisingly strong level, and stocks continue badly broken, especially in galvanized conduit. Shipments are uncertain. The price of ½-in. black per 1,000 ft. ranges from $87 to $92 and for ¾-in. black from $115 to $121 in lots of 5,000 ft.

Sockets.—Sales are only fair. Pull sockets are overstocked, but the supply of other types is about normal. In standard package quantities pulls are quoted at 51 cents net, but keys vary from 28 cents to 33 cents and keyless sockets from about 25½ cents to 28 cents.

Dry Cells.—The supply is good, but demand is only fair. No. 6 in barrel lots is worth 36 cents.

Bells and Buzzers.—Considerable scarcity has been felt and demand, while not especially heavy, is reported still ahead of production. Raw-material troubles are given as a cause.

Hollow Ware.—Present indications point to a considerable shortage. Demand is good but shipments are poor.

Porcelain.—The situation is slightly better, though the market remains greatly undersupplied. Few tubes are in stock, but knobs are coming in better.

Heaters.—Jobbers are well pleased with the buying season thus far. Stocks, however, are spotty, and it is not unusual to find a house entirely cleaned out.

Washing Machines.—During the past month demand has fallen off to a considerable extent. Manufacturers are beginning to catch up on deliveries, but not all jobbers are fully stocked. The Universal machine has been reduced from a flat rate of $225 to $195 in the East and $210 in the West, effective Nov. 6.

CHICAGO

Inactivity continues to mark every phase of the electrical industry in this section. The vague feeling that things would be better after election still prevails, though no one seems to be able to advance any good economic reason. Some jobbers report more inquiries than usual during the past week, but actual orders placed do not amount to much.

Activity of collection departments and the strict terms which are being insisted on for new business doubtless have some effect in keeping down the volume of business. With stocks accumulating in dealers' and jobbers' hands it is for the good of the industry that buying be done in accordance with sound credit conditions.

Wire.—Prices mentioned last week are still in effect. Demand is fairly steady from central-station companies and municipalities, and jobbers are all in position to make immediate shipment in any reasonable amount.

Motors.—The larger manufacturers are still well filled up with work. Some small makers will either have to book more orders soon or curtail production. Demand for sizes under 15 hp. still exceeds supply, but ordinary types can be obtained in three months or less. On larger sizes stocks, still ragged, are steadily accumulating.

Control Apparatus.—This is still hard to get. With the increased output of motor makers last summer many motors were shipped with control apparatus to follow, and this is still necessary in many cases. Prices are firm and deliveries range from sixty days to four months.

Tape.—Stocks are well filled up, owing to the reduction in demand. It is probable that reductions in the price of cotton, rubber, etc., are causing the trade to look for lowered prices soon.

Rigid Conduit.—The ½-in. and ¾-in. sizes continue to be scarce, but no reports are heard of jobs delayed through lack of material. Shipments are coming through from factories in good shape, and stocks in all other sizes are as large as is desirable.

Schedule Material.—With demand from contractors at a low figure, stocks are accumulating and some jobbers are showing a disposition to shade prices to get business. Porcelain parts are still almost unobtainable.

Fixtures.—Demand for house-lighting fixtures has remained good all through the fall and but little reduction has been noted in the past few weeks. The great amount of alteration work that has been under way has kept this class of material at a premium. Industrial lighting fixtures have also had heavy distribution, but this demand has slacked materially recently.

Electric Ranges.—Retail demand has fallen off in recent weeks. Jobbers' faith in good business throughout the winter is proved by the volume of business still being placed with manufacturers. Rural districts which recently obtained power service are those in which the heaviest demand is felt.

Christmas Goods.—Retailers are ordering from jobbers in disappointing quantities. Stores are making early displays, and inquiry by the public seems to be lively. Indications point to a belated but heavy sale of this material.

Washing Machines.—Locally retail sales are improving slowly and the number of inquiries is heavy. A general holding off to watch prices is evident, but with several manufacturers guaranteeing prices and with dealers generally

educating their trade to the fact that prices cannot drop now a resumption of buying is about due. Sales campaigns in surrounding territory are proceeding successfully.

BOSTON

Business continues dull in comparison with the midsummer tide. Jobbers are engaged largely in filling back orders and are buying from hand to mouth on account of overstocks. Collections are uneven. Prices are fairly steady, although downward pressure in wiring supplies is being felt. Building operations have not picked up much as yet, but a better feeling is apparent in the commercial world now that the election is over. Electrical manufacturers are still busy in this district on back orders. Large retail stocks remain to be disposed of before any general resumption of business is expected.

Wire.—No. 14 rubber-covered wire is quoted at $9.50 per 1,000 ft. in 5,000-ft. lots. Demand is slow and local stocks are of good size. Weatherproof base around Boston is 22¼ cents to 22½ cents.

Lamp Cord.—Quotations are slightly weaker. Twisted yellow and green cotton-covered cord sells for $30.59 per 1,000 ft. in 1,000-ft. lots. The supply is excellent for current needs, which are not very pressing.

Motors.—Cancellations on washing machine and cleaner-motor orders are enabling manufacturers to catch up somewhat on production, but the volume of back orders is so heavy that long deliveries are still being quoted. On 5-hp., three-phase induction motors thirty-eight weeks' delivery is quoted by a large manufacturing house. Prices are remarkably steady.

Flexible Armored Conductor.—No. 14 single-strip is selling for $85 per 1,000 ft. in 1,000-ft. lots. No large quantities appear to be moving, and some manufacturers are reported to be offering this material at $80 to the jobbing trade.

Non-metallic Flexible Conduit.—Prices hold firm as yet, but little of this material is moving. Local stocks are quite satisfactory. For ⅞-in. conduit, in 5,000-ft. lots, $33.50 per 1,000 ft. is asked, and for ¼-in. $36.50.

Radiators.—A steady demand is apparent and manufacturers are very busy. In one plant at least overtime evening work is being handled. Jobbers are quoting list less 25 per cent on lots of six or less. Production has increased so much that excellent deliveries can be had.

Washers and Cleaners.—The demand has fallen off a good deal, but prices are being held at recent levels.

Appliances.—Retail trade is spotty. Stocks in most lines are easily maintained, but in some quarters a shortage of immersion heaters and waffle irons is reported. Irons and toasters are moving well, and a fair demand for electric tableware in general exists.

ATLANTA

Despite the continued easing off in the volume of business there is now little or no pessimism expressed regarding the future outlook for business conditions. The general opinion seems to be that the slacking up is a healthy sign rather than otherwise. The wild buying of a few months back is noticeable by its absence, both jobbers and retailers placing orders only for their immediate needs. Jobbers have satisfactory stocks of nearly all standard lines and report an excess of some classes of material, specifically irons and loom. The latter article has been offered recently at prices a shade below the market quotations in an effort to move supplies. The retail trade is awakening to the expected demand for holiday goods and orders are beginning to arrive in fair volume.

Building activities in Atlanta continue to hold up very well, October permits reaching close to the million-dollar mark, a gain over October, 1919, of approximately $100,000. Local contractors report they have all the work on hand they can handle well, despite an easing labor market. Credits continue to be scanned closely and collections are not holding up well, especially from any lines connected with the automobile trade.

Meters.—The recent shortage in popular sizes continues, and it seems impossible to obtain 5-amp. and 10-amp., two-wire and three-wire types in sufficient volume. Customers' services have been held up as a result.

Distributing Transformers.—Two carloads of standard apparatus were received this week, serving to ease the situation materially. Back orders, however, will prevent the accumulation of any stocks.

Cable.—Difficulty in obtaining prompt shipments of lead-covered cable in 600-volt and 2,300-volt types is reported by jobbers. The demand continues to hold up satisfactorily owing, it is thought, in a measure to outstanding back orders.

Rigid Conduit.—Improvement in transportation has served to increase materially holdings of black pipe, nearly all sizes being at hand in sufficient quantity. Galvanized, however, is still short in popular sizes. Prices remain unchanged.

Safety Switches.—The demand is holding up remarkably well, showing less slump than any other line. Stocks and shipments continue quite good in all sizes. Prices on types without end plates, small quantities, two-pole, 30-amp., $2.04; two-pole, 60-amp., $10.40; three-pole, 30-amp., $7; three-pole, 60-amp., $14.40.

Lamps.—The heavy seasonal demand has depleted stocks of 40, 100, 150 and 200-watt sizes, and considerable difficulty is being experienced in meeting the requirements of the trade. The shortage is most pronounced in the 40-watt size.

Heaters.—The movement of beam-type heaters, which was brisk the latter part of October, has slowed up because of the warm weather. Dealers, however, predict a very satisfactory year beginning with the real winter weather. Stocks are quite satisfactory.

Portable Lamps.—Respectable stocks have been accumulated in anticipation of holiday demand. Sales are already on the increase and a satisfactory turnover is expected.

ST. LOUIS

Jobbers, manufacturers and retail dealers have spent a quiet week, owing in part to election activities, but in the main to the general dullness the market here has been feeling for some time. The demand for many items has dropped off considerably, and the market has become a buyers' market, with the exception of a few lines.

Stocks are becoming larger continually, and there is every indication that shortages will be few and far between by the first of the year. Deliveries on items which have been short for months are getting better, and in some cases this is working to the disadvantage of the jobber who pyramided his orders six months ago. Some cancellations are resulting. Jobbers also are receiving cancellations, but they are being encouraged by the number of "hold" orders they are receiving at the same time.

Production is being cut in a number of industrial plants, among them several electrical plants, and as a consequence labor has become much more tractable. Manufacturers report production per man increasing noticeably. Wages have not been lowered but many workers have been laid off.

One most encouraging factor is that collections have receded from a maximum of seventy days to about sixty days. This improvement is laid to the fact that customers are ordering less and thereby catching up on their bills.

Wire.—There are large stocks of rubber-covered and weatherproof on hand, but with the demand as low as it is jobbers are finding it hard to reduce them appreciably.

Rigid Conduit.—The shortage which had been existent here for some time has at length been relieved by large shipments from manufacturers, and jobbers' stocks of all sizes from ½-in. up to 4-in. black are much improved. Galvanized is not quite so plentiful, but stocks are fair. Prices are holding.

Bare Copper Wire.—Jobbers are quoting direct shipment from manufacturers and the market is very unstable. Current quotation is 18 cents base with little demand.

Farm-Lighting Plants.—Stocks are large and demand has been quiet, but several jobbers are planning to put on sales campaigns during November and expect business to become more active. Jobbers report that their volume of business on 32-volt accessories is almost as large as on the plants themselves. In several cases prices are being guaranteed until June 1, 1921.

Knobs, Tubes and Cleats.—There are large stocks of these items and demand is slow. Three-inch ⅞ tubes are quoted at $9.90 in lots of 1,000. The 5½ new code "Nail-it" knobs are quoted at $32 per 1,000. The maximum discount on cleats is 45 per cent.

Christmas-Tree Lighting Outfits.—Some jobbers report that, judging by the orders booked and those coming in at present dealers will do almost as large a volume of business as last year. Practically all the outfits sold here are the series type. Christmas-tree lamps are short, but jobbers expect to be able to get enough by the holiday season to take care of all their orders.

Magnet Wire.—This is becoming slightly easier, and it is quoted on a 23-cent base. Until a month ago no specific deliveries were being promised. At present jobbers can give delivery in from three to four months of both the enameled and silk-covered wire.

Heaters.—Stocks are spotty. It is reported that jobbers will have difficulty in getting deliveries from the factory until the first of the year, but there are enough in stock here to take care of a normal demand.

SAN FRANCISCO

By almost imperceptible degrees conditions have so changed that a buyers' market is unmistakably present. Stocks are beginning to pile up which require special sales effort to move them. There are still certain kinds of roughing-in material, such as boxes and flexible metallic conduit, that are eagerly sought among available sources, but in general it may be safely said that jobbers are figuring very closely because of quickened factory output.

The railroads are increasing their electrical purchases and are rapidly resuming their pre-war volume of buying. Moreover, their plans seem to promise within the next year or so an almost unprecedented increase in business.

Shipyard business has decreased, and several of the war yards have closed. Government yards, on the contrary, have never been so busy. This is because of the enlarged Pacific fleet.

Credit men report collections fair to middling, averaging about fifty days. They are proportioning quantity orders from dealers, especially for household appliances, strictly in accordance with a conservative rate of turnover.

Schedule Material.—Stocks of sockets, switches, cutoffs and similar articles are good, although some sizes of fuses are hard to get in packages. Eastern factories are making steady progress in unfilled orders.

Motors.—Once again dealers are able to solicit new business, particularly in industrial fields hitherto untouched. The motor demand is still, however, far in excess of supply.

Household Appliances.—The California co-operative campaign is mapping out an intensive advertising campaign for the Christmas season. A limiting factor is lack of stock. There is an excess of flatirons, but hardware stocks will melt long before the peak of the holiday demand is reached. The call for the larger household appliances has slackened in spite of strenuous efforts to increase sales.

SEATTLE—PORTLAND

The election has not so far stimulated business in Puget Sound territory. If anything, the past week's sales volume was lighter than ever. Aside from domestic appliances electrical merchandise is moving very slowly. Movement of schedule materials, conduit and similar articles used in building construction is showing a daily decrease. Motors and heavy power-apparatus sales are negligible and the call for pole-line equipment and street-lighting facilities is at a minimum. Optimistic authorities believe the new year will usher in a change for the better, while others hold that nothing much of consequence will transpire until early spring. Stocks, with the exception of conduit, are in good shape, and replacements in most cases are easy to obtain. There is a surplus of labor, both skilled and unskilled, and lumber mills, logging camps and larger industrial plants are cutting down forces. In the case of mills and camps many plants in both Oregon and Washington have closed down altogether. A cut in wages of lumber workers is imminent; in fact, several mills have announced wage cuts approximating 50 cents a day.

The general situation in Portland seems to be that many dealers are in a very precarious situation. Their assets exceed their liabilities, but inability to realize on these assets because of slow collections has brought about a rather serious condition. Many cancellations of orders have already been made, and in most cases buying is from hand to mouth. Portland jobbers report business good at the present time—in fact, somewhat better than was expected a few weeks ago. Stocks are improving very materially, with the exception of porcelain. Conduit stock is good now. At the present rate jobbers will be able to catch up on back orders within the next thirty or forty days. Line-construction tools, "Economy" fuses and lamp guards show a slight advance. Conduit in small quantities shows a 10 per cent increase, but in large quantities there has been no change. Single-braid rubber-covered No. 14 wire has dropped from $13.75 per 1,000 ft. to $13.10.

Lamp Cord.—Cotton-covered No. 18 has dropped from $33.30 per 1,000 ft. to $31.40.

Domestic Appliances.—In Seattle and Puget Sound cities washing machines, ironers, vacuum cleaners, flatirons and percolators are moving well. In the smaller towns and rural communities campaigns, including house-to-house solicitation, window demonstrations and newspaper advertising, are producing good results.

SALT LAKE CITY—DENVER

Although no tangible effects of the national election are discernible yet there is a decided feeling of relief and a looking forward to improved business among electrical jobbers and dealers. Actual trade conditions are not much improved over the past week. In many agricultural sections farmers are holding their wheat and potatoes for higher prices. As a result money continues scarce and buying by consumers is at a low ebb. One large retail concern with more than twenty branches in Utah and Colorado reports that the month is not coming up to expectations based on crop forecasts. Crops are bountiful, but marketing is proceeding slowly.

There is hesitancy on the part of electrical dealers to yield to the impulse of price cutting as they believe that the electrical trade will remain stable for several months to come so far as price schedules are concerned. There is little building under way. Contractors report that they are employing not more than one-fourth of their normal building force. Revived building activity is looked for in the early spring, but it is expected that the coming winter will be very quiet.

The credit situation is said to be steadily improving, although there are still long delays in collections. Special advertising campaigns are being put over by offering liberal arrangement of time payments. "Edison Day" was observed recently by the leading contractors, dealers and jobbers of Idaho. Discussion and special demonstrations of merchandising were a feature of the convention, while care and display of stocks was another topic taken up. A "fill your socket" campaign is to be carried vigorously to every part of the state. As a special inducement to the trade power companies are filling sockets and allowing the charge to be made on the monthly bill for service.

Porcelain.—Stocks have been very short for months, but contractors report that they are now able to get their orders filled at a satisfactory rate.

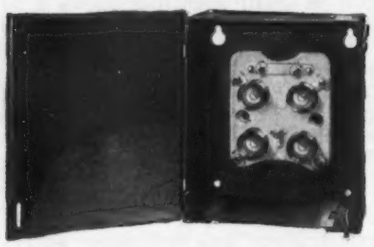
Christmas Tree Outfits.—An unusual effort is being made by jobbers to put this seasonal commodity on the market. Safety and attractiveness of a Christmas-tree adornment are the selling points being urged.

NEW APPARATUS & APPLIANCES

A Record of Latest Developments
and Improvements in Manufacturers' Products
Used in the Electrical Field

Inclosed Cut-Out

An inclosed cut-out to be used in conjunction with safety service switches has been developed by the Square D Company, Detroit, Mich. This cut-out No. 35,211 matches the Square D inclosed switches. It is designed for three-wire service with two-wire distribution or two-wire service with two-



SAFETY INCLOSED CUT-OUT

wire distribution. The ends are open to take any standard class "A" end plate. It is provided with two ½-in. and two ¾-in. knockouts on each side and two ½-in. and one ¾-in. knockout at top and bottom in the back of the box. It is designed for 30-amp., 125-volt plug fuses. The depth is 3⅛ in. and the weight 4 lb.

Battery Charging from Alternating-Current Line

Apparatus for continually charging storage batteries while in service from an alternating-current line has been developed by the Valley Electric Company, 3157 South Kings Highway, St. Louis, Mo. With this system the battery is continuously given a small charge from an alternating-current line through a rectifier. This vibrating-type rectifier is made for any commercial frequency and voltage, has only one moving element and operates in any position automatically.

Loom for Weaving Tire Fabrics

A machine designed to weave a rubber-saturated yarn and bead into a fabric securely cemented between each ply, automatically completing the construction of the carcass in one operation, has been developed by the Automatic Tire Machine Corporation, 23 Falls Street, Niagara Falls, N. Y. The machine is entirely electrically operated, the bobbin being moved from one side to the other by magnetic action and the pickers being actuated by solenoids. The yarn going into the fabric is saturated with rubber before being woven. The fabric for one tire is woven in a continuous length, thus avoiding the necessity for laps and joints.

Thirty-two-Volt Generating Plant

The engine of the 32-volt farm-lighting plant made by Carlton, Young & Catlin, Inc., Grand Central Palace, New York City, follows as nearly as possible standard automobile practice. A number of parts are interchangeable with those of the Ford automobile engine, including piston, connecting rod, time gears, valves, valve-spring seats, etc. The specifications include a 1½-kw., 37½-volt, direct-current, 1,200-r.p.m. generator, directly connected to a single-cylinder engine. The switchboard is mounted on the generator frame. The engine is designed to run on kerosene, gasoline or alcohol.

Toggle Switch for Household Appliances

A toggle switch for mounting on electrical household appliances has been developed by the Bryant Electric

FOR MOUNTING ON APPLIANCES

Company, Bridgeport, Conn. The base is of porcelain, the covers are polished nickel-plated brass. The manufacturer identifies this device by catalog No. 2902.

Four-Heat Disk Stove

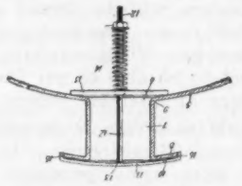
A disk stove equipped with a regulating plug for obtaining four degrees of heat has been developed by the Waage Electric Company, 6 Reade Street, New York City. An aluminium disk is used, as this metal, the maker declares, throws off heat quickly as it is a good heat conductor. The stove is built on a metal deck with fiber rests to avoid marring the table.

Cylinder-Type Clothes Washer

A cylinder-type clothes washer with all moving parts inclosed in a gray enameled cabinet has been developed by Landers, Frary & Clark, New Britain, Conn. The cylinder weighs 19 lb., is removable and when not operating locks automatically with the opening at the top. The washer has a capacity of six sheets, occupies a floor space 24 in. x 30 in. and weighs 285 lb.

Automatic Safety Valve for Oil-Filled Transformers

A safety valve to relieve abnormal pressure in oil-filled transformers has been developed by the Pittsburgh



FOR RELIEVING PRESSURE INSIDE OIL-FILLED TRANSFORMER

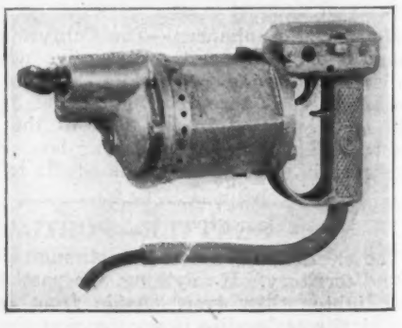
Transformer Company, Pittsburgh, Pa. An adjustable spring holds a plate from the inside, closing an outlet. It is claimed that the valve is automatic and that after it has relieved the pressure it will immediately reset and thus prevent rain or snow from entering the transformer.

Aerating Mixer for Kitchen Use

A mixer which aerates and mixes foods and liquids is being marketed under the name of "Whip-All" by the Air-O-Mix Corporation, 50 East Forty-second Street, New York City. The mixer is operated by a universal motor incased in a housing of brass casting nickel-plated. The device is 12 in. high and draws less current than a 50-watt lamp.

Two-Spindle Electrical Drill

A two-spindle drill for drilling two holes ¾ in. apart has been designed by the Black & Decker Manufacturing Company, Towson Heights, Baltimore, Md. The handle of the drill is like that of an automatic pistol, and a pull on the trigger sets the two bits in



DRILLS TWO HOLES AT ONCE

motion. A second pull stops the drill. The operator can control the tool without changing the position of either hand. The two spindles have chucks to hold ⅜-in. drill bits.

Machine to Test Permanence of Dyes

A "Color Fade-Ometer" to test the fastness to light of colors and dyestuffs has been developed by the Atlas Electric Devices Company, 360 West Superior Street, Chicago. It is said that this instrument tests dyes in a few hours as completely as a sunlight test requiring several weeks. Forty tests can be made at one time. The instrument operates automatically without an attendant. It is used for testing color in textile goods, paper, leather, paints, varnishes, inks, oil, etc.

Electric Immersion Heater

A new immersion water heater, the "Electro-Boil," the smallest model of which is said to bring cold water to the boiling point in three minutes, has been developed by the Milwaukee Manufacturing Company, 1316 Fond du Lac Avenue, Milwaukee, Wis. This device is composed of a metal cylinder with metal disks inside, perforated to admit a ready contact with water. For operation the heater is simply immersed in water and the current turned on. The four models range in size from 110 volts, 3 amp. (designed to boil one quart of water in seven minutes) to 110 volts, 30 amp. (to boil one gallon of water in one minute).

Automatic Switch for Battery Charging

An automatic switch designed to protect storage batteries while they are being charged by preventing a reverse flow of current from the batteries through the generator has recently been developed by the Hartman Electrical Manufacturing Company, Mansfield, Ohio. This switch is known as the "type L" automatic switch. When the alternating-current power fails a switch automatically disconnects the batteries, but when the power is restored the switch automatically closes again. It is rated at 30 amp. and can be used on either 110-volt or 220-volt circuits.

Water Heater Placed in Pipe Outlet of Container

A heater for application to water containers provided with pipe outlets has been recently designed by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis. These heaters fit threaded pipes of 1¼ in. or 2 in. inside

HEATER SCREWED INTO HOLE IN TANK

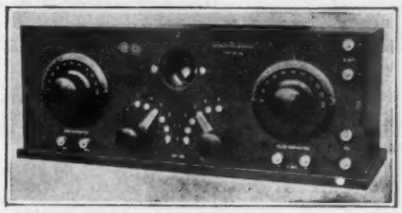
diameter. They are inserted through the walls of the vessel below the minimum water level. These heaters are made in different capacities, from 500 watts to 4,500 watts, on standard commercial voltages. The larger sizes have three heats, selected by means of a switch on the heater cord.

Automatic Stoker for Household Use

An electrically operated automatic stoker for residences is now being placed on the market by the Domestic Stoker & Manufacturing Company of Salt Lake City, Utah. The device consists of a stoker, a thermostat, a clock and control apparatus. A small electric motor operates the stoker, the draft and the circuit-changing mechanism. A conveyor carries the fuel from a hopper containing 250 lb. of slack coal to an oscillating chute projecting into the furnace, whence it is dropped on the center of a conical grate. The rate of feed may be varied from 6 lb. to 60 lb. an hour. The thermostat is situated in any living room. To insure that the fuel bed shall be replenished periodically irrespective of temperature requirements, a clock is provided which causes the stoker to feed a certain amount of fuel to the furnace each hour.

Regenerative Receiver and Vacuum-Tube Unit

In the "type CR-3A" short-wave regenerative receiver and vacuum-tube unit offered by A. H. Grebe & Company, Inc., 70 Van Wyck Boulevard, Richmond Hill, N. Y., the usual variometer tuning elements are used, but a departure in



IMPROVED COUPLING ELIMINATES ONE ADJUSTMENT

coupling design has been effected which eliminates one tuning adjustment. In the position ordinarily occupied by the coupler dial a standard four-prong vacuum-tube receptacle and grid condenser have been placed. The wavelength range is from 150 m. to 375 m.

Notes on Recent Appliances

Plug and Receptacle

The Electrical Outlet Company, 119 West Fortieth Street, New York City, has developed a fixture hanger and plug combined.

Pressure Switch

The Penn Electric Machine Company, Des Moines, Iowa, is offering a pressure-controlled switch.

Dishwasher

A dishwasher has been placed on the market by the Fitzgerald Manufacturing Company, Torrington, Conn.

Christmas Tree Lamp

A Christmas tree lamp of new shape has been brought out by the Westinghouse Lamp Company, Bloomfield, N. J.

Washing Machine

An electric washer has been brought out by the Fosston-Carpenter Company, 473 Cleveland Avenue, St. Paul Minn.

Flexible Light Holder

A flexible industrial light holder has been placed on the market by the Sterling Company, Sterling, Ill.

Branding Iron

An electrically heated branding iron has been placed on the market by the Detroit Electrical Branding Iron Company, 710 Farwell Building, Detroit, Mich.

Battery Bell

Bells and buzzers with self-contained dry batteries have been brought out by the Electric Signal Manufacturing Company, Inc., 31 Tremont Avenue, Orange, N. J.

Fractional-Horsepower Motor

Fractional-horsepower motors have been placed on the market by the A-C Electrical Manufacturing Company, Dayton, Ohio.

Hair Waving Machine

Hair wavers, both electrically heated and heated by electric stoves are being offered by Le Bijou Company, 186 North La Salle Street, Chicago.

Household Radiator

A radiator in sizes from 600 watts to 10,000 watts is being offered by the Electric Heating & Manufacturing Company. Westlake and Republican Streets, Seattle, Wash.

Volt Reader for Testing Batteries

In describing a volt reader for battery testing made by the Service Station Supply Company, 30 East Larned Street, Detroit, Mich., the wrong address was given in the ELECTRICAL WORLD of Oct. 2, 1920, p. 712. The correct address is that given above.

Semi-Indirect Lighting Unit

A semi-indirect lighting unit has been developed by H. G. McFaddin & Company, 38 Warren Street, New York City.

Washing Machine

The Hogan-Spencer-Whitley Company, Erie, Pa., has placed on the market a washing machine.

Machinery Blowing Outfit

The Black & Decker Manufacturing Company, Towson Heights, Baltimore, Md., is now making a No. 46 portable electric compressor equipped with reducing valve, hose and blow gun.

MANUFACTURERS' ACTIVITIES

Record of Changes Affecting Sales and Distribution Together with Trade Personals and Notes on Foreign Trade, Jobbers' News and New Trade Literature

THE DOUGLAS-RUDD MANUFACTURING COMPANY, Bronson, Mich., manufacturer of electric battery products, connections, etc., has filed notice of an increase in capital stock from $30,000 to $236,000.

THE WESTERN APPLIANCE MANUFACTURING COMPANY, Seattle, Wash., is planning to build a one-story plant at 5623 Duwamish Avenue, to cost about $25,000 exclusive of equipment. The plant will be used to manufacture a newly designed electrical ironing machine.

THE WESTINGHOUSE LAMP COMPANY, 165 Broadway, New York City, has filed plans for the erection of a four-story building, 80 ft. x 400 ft., on East Michigan Avenue, Indianapolis, Ind. The cost is estimated at about $500,000.

THE UNITED ELECTRIC COMPANY, Canton, Ohio, has filed notice of increase in capital stock from $500,000 to $1,000,000. The company manufactures suction sweepers.

THE INDUSTRIAL IGNITION COMPANY, Flint, Mich., is planning to build a new power house, to cost about $60,000.

THE REFRIGERATING MACHINE & HEATING COMPANY, Detroit, Mich., has filed notice of change in name to the Refrigerating Machinery Company.

THE SUNSHINE SAFETY LAMP COMPANY, 1005 McGee Street, Kansas City, Mo., is considering plans for the erection of a one-story-and-basement building, 50 ft. x 115 ft., on Walnut Street. The company manufactures electric lamps.

THE IDEAL GAS & ELECTRIC FIXTURE COMPANY, 433 Broadway, New York City, manufacturer of brass and other metal electric and gas fixtures, has filed notice of increase in capital stock from $10,000 to $70,000.

THE EASTERN ELECTRICAL SUPPLY COMPANY, 798 Broad Street, Newark, N. J., has taken over the three-story-and-basement building, 47 ft. x 90 ft., at 88-90 Academy Street, for its proposed new works.

THE ELECTRIC STORAGE BATTERY COMPANY, Nineteenth and Allegheny Streets, Philadelphia, has awarded contract for another factory building, to cost about $100,000, at its new plant on Rising Sun Avenue.

THE ELECTRO-REFRACTORIES CORPORATION, Buffalo, N. Y., has filed notice of increase in capital stock fom $200,000 to $550,000.

THE UNION ELECTRIC & MACHINE COMPANY, Charleston, W. Va., has filed notice of increase in capital stock to $50,000.

THE BERG-CLARK ELECTRIC COMPANY, 10207 Euclid Avenue, Cleveland, Ohio, is planning to erect a factory and warehouse at St. Clair Avenue and East Fourteenth Street, Cleveland, to cost about $50,000.

THE DIAMOND CARBON COMPANY, Wardville, La., contemplates additions to its plant, including the installation of machinery, to cost about $250,000.

THE R. D. NUTTALL COMPANY, Pittsburgh, Pa., has established permanent quarters at 429 Title and Trust Building, Philadelphia, in charge of R. F. Fiske, to handle direct all business other than electric railroad and mine haulage supplies and equipment.

LANDERS, FRARY & CLARK, New Britain, Conn., are considering increasing their capital stock by $1,000,000, the new shares to be sold to stockholders at $25 each. The proceeds will be used in part for new construction.

THE GREENFIELD (MASS.) TAP & DIE CORPORATION is offering for public subscription $2,225,000 8 per cent cumulative preferred stock (par $100), a part of an issue of $5,000,000. The company has an authorized capital stock of $11,500,000, of which $6,755,000 is outstanding at the present time.

THE ROLLER-SMITH COMPANY, 233 Broadway, New York City, announces the appointment of L. Brandenburger, 59 West Broadway, Salt Lake City, Utah, as its representative in Utah and parts of Idaho, Wyoming and Montana. Mr. Brandenburger will handle the company's entire line of instruments, meters and circuit breakers in that territory in addition to representing the Wagner Electric Manufacturing Company, the Delta-Star Electric Company, the American Insulated Wire & Cable Company, and the Esterline Company. Mr. Brandenburger was formerly with the Telluride Power Company, and later with its successor, the Utah Power & Light Company. Since 1916 he has been in Salt Lake City as a manufacturer's agent, specializing in electrical apparatus.

THE CUTLER-HAMMER MANUFACTURING COMPANY has again increased the space of its New York City office at 50 Church Street. This is the fourth increase since the company has occupied space in the Hudson Terminal Building, the latest addition being on the ground floor, where the new offices are half as large as those on the nineteenth floor.

THE GENERAL ELECTRIC COMPANY, Schnectady, N. Y., has recently awarded the contract for the erection of an addition to its plant at Lynn, Mass., 180 ft. x 250 ft., with three ells, 40 ft. x 40 ft., 15 ft. x 40 ft. and 12 ft. x 20 ft., to cost about $150,000. The company, it is stated, will hold in abeyance plans for its proposed five-story plant at Springfield, Mass., and will ask for bids in 1921. The building will be 75 ft. x 800 ft. and cost about $500,000.

FRED E. RUSSELL, contracting engineer, who recently invented an insulated stove which heats an oven on all six sides, has moved his works and general offices to Langhorne, Pa. He also maintains an office in the Otis Building, Sixteenth and Sansom Streets, Philadelphia.

THE R. H. BEAUMONT COMPANY, 319 Arch Street, Philadelphia, has recently established an office at 230 Fifth Avenue, Pittsburgh, Pa. Thomas Widdop is in charge.

THE HURON STEEL COMPANY, Cleveland, Ohio, announces that it has made arrangements with the W. H. Gilbert Sales Company, with offices in Los Angeles, San Francisco, Cal., and Seattle, Wash., as Pacific Coast agent to handle its products and those of its subsidiary, the Ohio Steel Products Company, which include boiler tubes, lap and butt weld pipe, acetylene welded tubing, rigid and flexible conduit and metal molding.

THE PEERLESS INSULATED WIRE & CABLE COMPANY, Pennington, N. J., has made arrangements for the construction of an addition to its works for the manufacture of weatherproof wire products, to cost about $50,000.

THE CROUSE-HINDS COMPANY, Syracuse, N. Y., manufacturer of condulets and other electrical products, has removed its Philadelphia office from the Franklin Trust Building to the Otis Building, where it has much larger quarters.

THE GASSER MANUFACTURING COMPANY, Trenton, N. J., recently incorporated with a capital stock of $500,000, is planning to erect a new factory, 100 ft. x 100 ft., for the manufacture of special electrical equipment. The cost of the building is estimated at about $85,000. The company has established temporary offices at 402 Greenwood Avenue.

THE HEULE ELECTRIC HEATER COMPANY, Cleveland, Ohio, has made arrangements with the Chamber of Commerce of Massillon, Ohio, to locate in that city. It will establish a plant there to manufacture electric heating equipment for residences.

Supply Jobbers' Notes

THE GENERAL ELECTRIC COMPANY has purchased a large site in Atlanta, Ga., and has begun construction on what will be one of the largest electrical warehouses in the South. The preliminary construction will provide for warehousing space amounting to approximately 100,000 sq.ft., with plans for extensions as requirements demand. The new location was chosen with a particular view of providing freight and express terminal facilities, and it is expected that the building will be ready for occupancy by April 1, 1921.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

A commercial agency in India (No. 33,926) desires to import various American products, including electrical goods, etc.

A firm in Sweden (No. 33,929) desires direct communication with American manufacturers of copper wire, cables, bars and sheets, brass wire, bars and sheets, and aluminum sheets.

Foreign Trade Notes

AMALGAMATION IN JAPAN.—In the hope of stabilizing the elecrical industry in Japan, the government there is reported as intending to amalgamate all the electrical interests. It is thought that such a combination would make the development of water power easier and more economical and simplify the raising of capital.

THE INTERNATIONAL WESTERN ELECTRIC COMPANY, New York, is planning the opening of a new branch at Singapore in the Malay Peninsula. The new office will handle the trade of the Straits Settlements, the Federated Malay States, Borneo, Siam, Ceylon, Burma and the Dutch East Indies.

GREAT INCREASE IN USE OF ELECTRICITY IN SWEDEN.—Owing to the scarcity and the high cost of coal in Sweden the development of water power to supply electricity for railway, mining and industrial purposes is increasing rapidly. The existing hydro-electric plants, it is stated, are capable of generating 1,150,000 hp., while works under construction will soon add another 250,000 hp. The equipment of the plants, such as turbines, generators, transmission line, etc., is largely of Swedish manufacture, but some of the distributing apparatus, motors, etc., have been imported. Four large generating stations belong to the state and thirty-two (of more than 5,000 hp. capacity) to private companies. The railway from Kiruna to the Norwegian frontier was electrified some years ago. The Kiruna-Lulea, Stockholm-Gothenberg and Nordmark-Klaralfoen lines are now being equipped for electrical operation. At present 19,000 km. of electric transmission lines are owned by private companies. The government is empowered to grant loans to private companies for carrying out hydro-electric enterprises, while 14,000,000 crowns have been voted for completing the work of introducing electric traction on the state railways.

Trade Publications

INGOTS, BEARINGS AND CASTINGS.—The Ajax Metal Company, Philadelphia, Pa., is distributing a new catalog covering the Ajax metal products, including white metal alloys, bronze and brass ingots, bearings and castings. This catalog has been published in two editions, one in English and the other in Spanish.

TRANSMISSION MACHINERY. — The A. & F. Brown Company, Elizabethport, N. J., has issued a new catalog entitled "Power Transmission Machinery," covering its line of power transmission apparatus and equipment.

GENERATORS AND EXCITERS. — The General Electric Company, Schenectady, N. Y., has issued bulletin No. 40,017A, superseding No. 40,017, which describes its small direct-current generators and exciters, type M L.

INSULATED WIRE AND CABLE.—The Okonite Company, Passaic, N. J., has just published a 104-page illustrated handbook, covering insulated wire and cable.

SPLICING MATERIAL. — The Okonite Company, Passaic, N. J., has issued a folder entitled "Spliced for Life," on insulating tape, cement and Manson friction tape.

FANS.—The Robbins & Myers Company, Spingfield, Ohio, has issued domestic catalog No. 1153, dated Nov. 1, on "Electric Fans for A.C. and D.C. Circuits."

GRAPHIC METERS. — The Esterline Company, Indianapolis, Ind., is sending out a circular entitled "What Shall It Profit a Man?"

COTTON-MILL DRIVE. — The Westinghouse Electric & Manufacturing Company has issued leaflet 1910, which describes and illustrates "Electric Drive for Cotton Openers and Pickers."

New Incorporations

THE ROSS ELECTRIC APPLIANCES, Ltd., Toronto, Ont., has been incorporated by Charles A. Barron, 268 Sherbourne Street; John H. Ross, William N. Irwin and others. The company is capitalized at $40,000 and proposes to manufacture electrical supplies as well as appliances, motors, etc.

THE CALIFORNIA AUTOMATIC LIGHT COMPANY, 715 South Flower Street, Los Angeles, Cal., has been organized by F. P. Clarke and others to manufacture electric and other lighting equipment.

THE RURAL LIGHT & POWER COMPANY, Kimballton, Iowa, has been incorporated with a capital stock of $25,000. Olaf Hanson is president of the Rural company.

THE CONSOLIDATED ELECTRIC COMPANY, Muscatine, Iowa, has been incorporated with a capital stock of $10,000. The officers are F. C. Stroup, president, and R. R. Miller, secretary and treasurer.

THE CORWIN ELECTRIC COMPANY, Lafayette, Ind., has been incorporated by Elmer E. Corwin, S. M. Johnson and William Stone. The company is capitalized at $10,000 and proposes to manufacture telephone and electrical appliances.

THE LIVE WIRE ELECTRICAL APPLIANCE COMPANY, 181 Griffith Street, Jersey City, N. J., has been organized to manufacture electrical devices. Edward Mohlen is one of the incorporators.

THE LYONS ELECTRIC APPLIANCE COMPANY, Bridgeton, N. J., has been incorporated by John P. Lyons, R. Elmer Shoemaker and Frank R. Bacon. The company is capitalized at $100,000 and proposes to manufacture electrical appliances and equipment.

THE FERNANDO C. MESA COMPANY, Newark, N. J., has been chartered with a capital stock of $1,500,000 to manufacture electrical wiring devices and equipment. The company, it is understood, will be located in the plant on Chancellor Avenue in the Waverly section, for the manufacture of ammunition, now occupied by the above concern. The incorporators are F. C. Mesa, Roy J. Harding, James Mango and Joseph Price.

THE GUARANTEE BATTERIES, LTD., Guelph, Ont., has been incorporated by Charles L. Dunbar, Leo W. Goetz, James Sutherland and others. The company is capitalized at $300,000 and proposes to manufacture tools, electrical equipment, etc.

THE COAST REFRIGERATING FACILITIES, INC., Atlantic City, N. J., has been incorporated by H. H. Jennings, George S. Brooks and William C. Marshall. The company is capitalized at $400,000 and proposes to manufacture refrigerating machinery and apparatus.

THE WEIDMAN & MOHR MACHINE COMPANY, Lancaster, Pa., has been chartered by James B. Weidman, Charles A. Mohr and W. M. Murphy. The company is capitalized at $300,000 and proposes to manufacture machinery and tools, including electrical apparatus.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

Middle Atlantic States

CONCORD, N. Y.—The Iroquois Utilities, Inc., City Bank Building, Syracuse, has applied to the State Public Service Commission for permission to construct an extension of its system in Concord. B. H. Shepard is president.

FOWLER, N. Y.—The State Public Service Commission has granted the St. Lawrence Transmission Company, Potsdam, permission to construct an electric plant in Fowler (Gouverneur P. O.).

MASSENA, N. Y.—The Louisville Power Corporation, Walter G. Wilson president, contemplates the erection of a hydro-electric plant on the St. Lawrence River. H. L. Cooper & Company, 101 Park Avenue, New York City, is engineer.

NEW YORK, N. Y.—New bids will be received by the Board of Education, 500 Park Avenue, until Nov. 22 for the installation of electrical equipment to cost about $40,000, in Public School No. 62, Borough of The Bronx. C. B. J. Snyder, twenty-eighth floor, Municipal Building, is engineer.

NIAGARA FALLS, N. Y.—The Lower Niagara River Power & Water Supply, J. J. Albright president, Lewiston, contemplates the erection of a hydro-electric plant. H. L. Cooper & Company, 101 Park Avenue, New York City, is engineer.

NEWARK, N. J. — A referendum was passed at the recent general election for the installation of an electric and gas light, heat and power plant. Commissioner Raymond is director of the Department of Streets and Public Improvements.

ALTOONA, PA.—The Logan Valley Electric Railway Company, Eleventh Street and Twelfth Avenue, contemplates the construction of about 3 miles of new line, connecting present system, at a cost of about $40,000. Francis Tingley is chief engineer.

ERIE, PA.—Extensions to the municipal fire-alarm system to cost about $86,000 are being planned by City Electrical Engineer Crane.

FREEMANSBURG, PA.—The New Jersey Zinc Company contemplates making changes in its power equipment, installing additional motors, rearrangment of drives, etc. H. A. Baruch is superintendent.

ABERDEEN, MD.—Bids will be received by the Constructing Quartermaster, Aberdeen Proving Ground, until Nov. 18 for the erection of a generator house and other buildings. Plans and specification may be obtained at the above address.

BALTIMORE, MD.—The rebuilding of its power-plant building is contemplated by the Church Home & Infirmary, Rev. Dr. A. C. Powell, chairman, Stoney Run Lane, University Parkway. Wyatt, & Nolting, Keyser Building, are architects.

BALTIMORE, MD.—Plans for the installation of a 'phone and signal system as a guard against theft are under consideration by Col. E. Austin Baughman, automobile commissioner of Maryland. Plans include the installation of a switchboard to cost about $5,000.

CHARLESTON, W. VA.—The Bureau of Yards and Docks, Navy Department, Washington, D. C., contemplates the installation of substation switchboards. (Specifications 4308.)

North Central States

DETROIT, MICH.—Plans are under way by Louis Kamper, architect, 751 Book Building, for the erection of a meat products factory for the Orling Brothers, Heidelberg and Elmwood Avenues, to cost about $200,000. Electric light equipment and motors for machines will be installed.

DETROIT, MICH.—Bids will be received by Harry Brabyn, secretary of the Board of Fire Commissioners, Wayne and Larned Streets, until Nov. 22 for the erection of a pumping station. Bids will also be received at a later date for two motor-generator sets for the operation of pumps and electrical generating equipment for lights. Smith, Hinchman & Grylls, 710 Washington Arcade, are engineers.

DETROIT, MICH. — The Michigan Elevated Railway Company, 711 Dime Bank Building, has applied to the State Public Utilities Commission for permission to construct a first unit of an elevated railway system from Detroit to Royal Oak, to cost about $491,000 per mile. Plans include an electric transmission line.

MENOMINEE, MICH. — The Michigan Electro-Chemical Company contemplates improvements to its power plant including the installation of additional equipment. Cahill & Douglas, 217 West Water Street, Milwaukee, are engineers.

ASHTABULA, OHIO. — An issue of $1,000,000 in bonds for the erection of a new electric light and power plant was carried at a recent election.

EASTON, OHIO. — The County Commissioners have granted W. T. McCabe a franchise to erect and maintain an electric transmission line in Preble County.

HURON, OHIO.—An issue of $42,000 in bonds for improvements to the electric light plant was recently voted on.

SPRINGFIELD, ILL.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 24, for conduit and wiring changes in the post office and court house.

GREEN BAY, WIS.—The De Pere Light & Power Company contemplates improvements and extensions to cost about $150,000.

MARSHFIELD, WIS. — The Board of Public Works has plans under way for the erection of an addition to the power house to cost about $25,000. John Seubert is city clerk.

MILWAUKEE, WIS. — The Milwaukee Bridge Company, C. Trimbarn president, 1400 Thirty-fourth Street, contemplates improvements to its power plant. Cahill & Douglas, 217 West Water Street, are engineers.

NORWALK, WIS.—The Wisconsin River Power Company, Madison, is considering the extension of its lines to this place at a cost of about $14,000.

WAUSAU, WIS.—The Wisconsin Valley Electric Company, 206 Third Street, contemplates the erection of a 6,000-hp. electric and water-power plant and dam at this place to cost about $600,000. L. A. DeGuere, Grand Rapids, Mich., is engineer.

WEST BEND, WIS.—Bids are being received by the Miller Spouting Company, Inc. P. O. Box 425, for equipment to cost about $20,000 for new factory, including twelve 220-volt, 60 cycle, three-phase motors, switchboard, etc.

NEW PRAGUE, MINN.—A meeting of the City Council was held recently for the purpose of discussing the construction of an electric light plant. J. F. Bruzek is city clerk.

CALAMUS, IOWA.—The Iowa Electric Company, Cedar Rapids, contemplates the erection of a transmission line from this place to the Wapsisinicon River vicinity.

DAVENPORT, IOWA.—The city officials contemplate repairs to the street-lighting system. Hugo Moeller is city clerk.

Southern States

MACON, MISS.—An issue of $25,000 in bonds will be submitted to the voters on Nov. 15 for the purpose of improving and repairing the light and water plants.

COTTER, ARK.—The Dixie Power Company, W. V. Powell president, Title Guaranty Building, St. Louis, Mo., is having plans prepared for the erection of a hydro-electric dam on the White River. Col. Henry A. Allen, 23 Metropolitan Block, Chicago, Ill., is engineer.

BIG HEART, OKLA. — The Big Heart Light & Power Company, recently incorporated, contemplates the installation of two units and will purchase transfomers, meters, etc. P. J. Minck is secretary.

LOCUST GROVE, OKLA.—The city officials have appointed V. V. Long & Company, engineers, Colcord Building, Oklahoma City, to make survey for a transmission line and distribution system to cost about $35,000.

FORT WORTH, TEX.—Thomas Holiday, Longview, has plans under way for the erection of an electrically operated sawmill at 800 North Houston Street, to cost about $250,000.

TERRELL, TEX.—The City Commission will receive new bids for furnishing and installing two 5-in. two-stage electrically driven centrifugal pumps, 500 to 800 gal. per minute against a 200-ft. head, direct-connected to a two-phase or three-phase, 60-cycle, 2,200-volt electric motor adequate to operate pumps at full capacity; installation to be made complete with all electric wiring, etc.; also, as a counter proposition, for two 5-in. three-stage centrifugal pumps, 500 to 800 gal. capacity, belted to two or three 75-hp. oil engines of high compression type. Former bids were rejected.

WAXAHACHIE, TEX.—The City Council has voted to hold an election soon for the purpose of submitting to the voters a proposition to issue $9,000 in bonds for the erection of a municipal electric lighting plant.

Pacific and Mountain States

ILWACO, WASH.—It is reported that the town officials are considering the purchase of the distribution system of the North Shore Light & Power Company and the installation of a 1,000-kw. generating plant. E. E. Wood is manager.

LA CENTER, WASH.—The installation of an electric lighting system at this place is contemplated.

SEATTLE, WASH.—The Pacific Coast Coal Company, L. C. Smith Building, has petitioned the King County Commissioners for permission to erect poles and wires for a 13,000-volt electric transmission line from its Hyde mines to its Black Diamond Mines.

VANCOUVER, WASH.—According to N. J. Blagen, the Blagen Sawmill will be erected below the city at a cost of about $140,000. Plans include the development of electrical energy to the extent of about 15,000 kw.

BANDON, ORE.—The Bandon Power Company, with the view of building a larger electric power plant at this place, a dam at Willow Grove and a 20-mile transmision line to Bandon, has offered its entire plant, system, etc., to the city for $35,000. Engineers estimate the probable cost of the new system at $105,000.

EL CENTRO, CAL.—The installation of an ornamental lighting system on Main Street and several other streets is contemplated.

FRESNO, CAL.—The San Joaquin Light & Power Corporation contemplates extensive water-power developments in Fresno County. The most costly projects are on the Kings River and on the North Fork of this river. On the main stream 35,795 hp. will be developed at a cost of about $4,850,000, and the two projects on the North Fork call for the development of 70,738 hp. and 85,568 hp., at a cost of $9,600,000 and $11,600,000 respectively. Other developments are planned at Bear Creek, where a dam will be erected for storage purposes; also the development of 8,409 hp., at a cost of $1,200,000, and at Deer Creek, 8,834 hp., costing $1,200,000.

HOLLYWOOD, CAL.—The Board of Trade has completed final details for plans to install street-lighting system to cover the entire section of Hollywood at a cost of about $1,500,000.

HUENEME, CAL.—The Board of Trade is contemplating the formation of a lighting district at this place.

REDLANDS, CAL.—It is understood that the Southern Sierras Power Company, Riverside, contemplates the erection of two power houses in Mill Creek Canyon, for the generation of 2,500 hp.

Canada

ST. THOMAS, ONT.—The Ontario Hydro-Electric Commission, care of Mr. Gaby, chief engineer, University Avenue, Toronto, will have estimates and reports prepared regarding cost of constructing an electric railway from St. Thomas to Simcoe.

WESTMOUNT, QUE.—Bids will be received by the city engineer until Dec. 1 for 4,000 ft. of cable and a power-house switchboard.

Miscellaneous

PANAMA.—Bids will be received at the office of the General Purchasing Officer of the Panama Canal, Washington, D. C., until Nov. 26 for furnishing electric cable, electric switches and receptacles, transformer, etc. (Circular 1417).

Record of Electrical Patents

Notes on United States Patents

(Issued Aug. 17, 1920)

1,349,978. Convertible Plate for Electrical Plug Receptacles; Adolph C. Recker, Oakville, Conn. App. filed Sept. 20, 1919. For use with screw plug and push plug.

(Issued Aug. 24, 1920)

1,350,658. Open-Slot Conduit; Franklin P. Lawrence, University City, Mo. App. filed Dec. 23, 1918. Formed in baseboard or ceiling molding.

(Issued Nov. 2, 1920)

1,357,160. Electric Battery; Harry F. French, Fremont, Ohio. App. filed Feb. 17, 1916. No precipitation.

1,357,197. Electric Transformer; Herbert B. Brooks, Washington, D. C. App. filed Nov. 1, 1919. Instrument transformers.

1,357,199. Telegraphy; Charles E. Hay, Essex, England. App. filed Nov. 14, 1916. By constant-period impulses.

1,357,210. Electromagnetic-Wave Navigational System; James Robinson, Biggin Hill, England. App. filed Dec. 16, 1919. Direction indicator.

1,357,215. Section Insulator; Lemuel S. Boggs, Springfield, Mass. App. filed Feb. 4, 1916. For trolley lines.

1,357,223. Converting System; Lewis W. Chubb, Edgewood Park, Pa. App. filed May 7, 1917. By rectifiers.

1,357,227. Exciting System for Commutating Poles in Dynamo-Electric Machinery; David C. Davis, Wilkinsburg, Pa. App. filed Feb. 8, 1918. For satisfactory commutation over wide range of armature reaction.

1,357,229. System of Distribution; Chas. Le G. Fortescue, Pittsburgh, Pa. App. filed Feb. 7, 1916. To maintain constant voltages.

1,357,230. Branding Iron; Joseph C. Garner, Detroit, Mich. App. filed June 5, 1920. Electrically heated.

1,357,257. Switching Device; Joseph Slepian, Wilkinsburg, Pa. App. filed Sept. 16, 1918. For preventing arcing.

1,357,264. Magnetic Modulator; Karl S. Van Dyke, Chicago, Ill. App. filed Sept. 27, 1919. For modulating carrier currents.

1,357,283. Battery Cover; John W. Fitzgerald, Detroit, Mich. App. filed April 1, 1920. Quickly attached.

1,357,287. Electric Heater Faucet; George H. Hart, Hartford, Conn. App. filed Feb. 18, 1919. Switch controls current and water.

1,357,290. Method of Manufacturing Graphite Articles; Frank R. Kemmer, Niagara Falls, N. Y. App. filed Dec. 18, 1919. In electric furnace.

1,357,296. Substation Circuits; William H. Martin, New York, N. Y. App. filed Dec. 19, 1918. Anti-side-tone type.

1,357,297. Solder; Bird E. Newell, Watson, Minn. App. filed Nov. 8, 1919. New formula.

1,357,303. Reverting-Test Circuit for Telephone Systems; Michael B. Stazak, Chicago, Ill. App. filed April 27, 1914. Busy signal.

1,357,332. Wire Connector; Charles P. McDonald, Kansas City, Mo. App. filed Feb. 14, 1920. Keeps slack out of trolley wire.

1,357,378. Storage-Battery Separator and Process of Producing the Same; Harry L. Boyer, Trenton, N. J. App. filed Feb. 6, 1919. Strong insulating ribs.

1,357,379. Process of Making Storage-Battery Separators; Harry L. Boyer, Trenton, N. J. App. filed Feb. 27, 1919. Of compressed fibrous material.

1,357,384. Controller for Motor-Driven Machines; William E. Date, Westfield, N. J. App. filed Dec. 6, 1917. For rubber mills.

1,357,391. Apparatus for Taking Serial Roentgenograms; Ferinand Freytag, San Rafael, Cal. App. filed July 24, 1916. Moving X-ray pictures.

1,357,400. Electrolytic Cell; Omar H. Jewell, Chicago, Ill. App. filed March 4, 1920. Production of caustic soda and chlorine.

1,357,401. Electrolytic Cell and Method of Using the Same; William M. Jewell, Chicago, Ill. App. filed April 21, 1919. Manufacture of chlorine, caustic alkali and hydrogen.

1,357,454. Wire Splicer; Lloyd M. Hellyer, Holden, W. Va. App. filed April 30, 1920. Trolley.

1,357,484. Gear-Changing Device; Thorsten von Zweigbergk, Lancaster, England. App. filed July 1, 1918. Electric machine in combination with mechanical gearing.

1,357,495. Metallurgical Process; William E. Greenawalt, Denver, Col. App. filed June 10, 1918. Treatment of copper ores.

1,357,548. Electrical Accumulator Plate; Chaimsonovitz P. Elieson, London, England. App. filed Dec. 10, 1919. Planté.

1,357,580. Method of Treating Fibers; Herbert R. Moody and Lewis H. Friedburg, New York, N. Y. App. filed Jan. 13, 1917. In electrolyzed brine.

1,357,582. Generator and Cut-Out Switch Apparatus; William B. Moses, Watertown, Mass. App. filed Aug. 18, 1919. Attached on generator.

1,357,604. Electrotester for Testing Automobile Motors; Leland R. Willits, Atlantic City, N. J. App. filed March 15, 1918. For testing spark plugs.

1,357,606. Soldering Iron; Launce R. Barber and Joseph A. Baker, Sharon, Pa. App. filed Dec. 11, 1919. Heated by internal arc.

1,357,613. Electric Power Hammer; Ralph F. Cianfrone, West New York, N. J. App. filed May 16, 1918. Reciprocating.

1,357,622. Railway Telephone System; Nicola de Ritis, Binghamton, N. Y. App. filed July 9, 1919. To talk with moving car.

1,357,648. Electric Heating Iron; Nels A. Nelson, Bode, Ia. App. filed Sept. 9, 1918. Arc-heated.

1,357,657. Method of and Means for Generating Low-Frequency Electrical Oscillations; Edward O. Scriven, New York, N. Y. App. filed Sept. 21, 1918. Vacuum tube.

1,357,681. Time-Limit Relay; George A. Burnham, Saugus, Mass. App. filed May 26, 1917. Magnetic drag.

1,357,695. Switch Mechanism for Starting Electric Motors; John Eaton, Schenectady, N. Y. App. filed Jan. 15, 1920. For starting squirrel-cage motors.

1,357,710. Method of and Apparatus for Automatically Removing Gases; William K. Kearsely, Jr., Schenectady, N. Y. App. filed Nov. 29, 1918. For treating electrical discharge devices.

1,357,724. Electric Lamp for Projection Apparatus; John E. Randall, Cleveland, Ohio. App. filed Jan. 15, 1917. Filaments mounted in panel form.

1,357,746. Control System; John F. Tritle, Schenectady, N. Y. App. filed July 29, 1918. For electric transmission in automobiles.

1,357,773. Rheostat; Mary H. Greenewalt, Philadelphia, Pa. App. filed Dec. 10, 1919. To vary brightness of a lamp.

1,357,827. Method of Operating Electrodes for Searchlights; Elmer A. Sperry, Brooklyn, N. Y. App. filed Dec. 22, 1915. Flaming arc.

1,357,850. Water-Level Indicator; Thomas S. Derr, Brookline, Mass. App. filed July 2, 1919. For steam-propelled vehicles.

1,357,858. Battery; Joseph R. Fenwick, Hampton, New Brunswick, Canada. App. filed March 20, 1919. Not affected by overcharge.

1,357,875. Traffic-Signaling System; Alexander W. Kent, Los Angeles, Cal. App. filed March 5, 1917. Four signals at each corner.

1,357,891. Portable Instantaneous Water Heater; Henry S. Murray, Denver, Col. App. filed July 15, 1920. Heats thin sheet of water.

1,357,901. Electric Furnace; Robert R. Reed, Ithaca, N. Y. App. filed March 27, 1920. For protecting the resistors from oxidation.

1,357,926. Binding Post for Electric Wires; Allen T. Baldwin, Elizabeth, N. J. App. filed July 18, 1919. Spring grip.

1,357,933. Electric Regulator; William A. Turbayne, Buffalo, N. Y. App. filed May 3, 1911. For battery charging.